Supporting Information
For

Copper-Catalyzed Reductive Coupling of Tosylhydrazones with Amines: A Convenient Route to α-Branched Amines

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List of Contents

General Experimental Methods

All glasswares were oven-dried at 140°C and all reactions were conducted under a nitrogen atmosphere. Solvents: cyclohexane and ethyl acetate (EtOAc), for chromatography were distilled before use. Dioxane was pre-dried with $CaCl_2$. Then reflux the pre-dried solvent over Na (1% w/v) and benzophenone (0.2% w/v) under an inert atmosphere until the blue colour of the benzophenone ketyl radical anion persists. Distil, and store it over 4A molecular sieves in the dark.

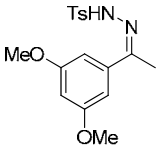
Instrumentation

The compounds were all identified by usual physical methods, i.e. ^{1}H-NMR, ^{13}C-NMR, IR, elemental analysis. ^{1}H and ^{13}C NMR spectra were measured in $CDCl_3$ with a Bruker ARX 400 or Bruker Avance 300 and chemical shifts are reported in ppm. The following abbreviations are used: m (multiplet), s (singlet), br s (broad singlet), d (doublet), t (triplet) dd (doublet of doublet), td (triplet of doublet), q (quadruplet). IR spectra were measured on a Bruker Vector 22 spectrophotometer (neat, cm^{-1}). Elemental analyses were performed with a Perkin-Elmer 240 analyser. Analytical TLC was performed on Merck precoated silica gel 60F plates with detection by exposure to ultraviolet light (254 nm) and by immersion in a staining solution of 20% phosphomolybdic acid in EtOH or vanillin stain (vanillin, concentrated H_2SO_4, EtOH). Merck silica gel 60 (230-400 mesh) was used for column chromatography. Melting points (m.p.) were recorded on a Büchi B-450 apparatus and were uncorrected.

General Procedure for Preparation of Tosylhydrazone from Ketone[1]

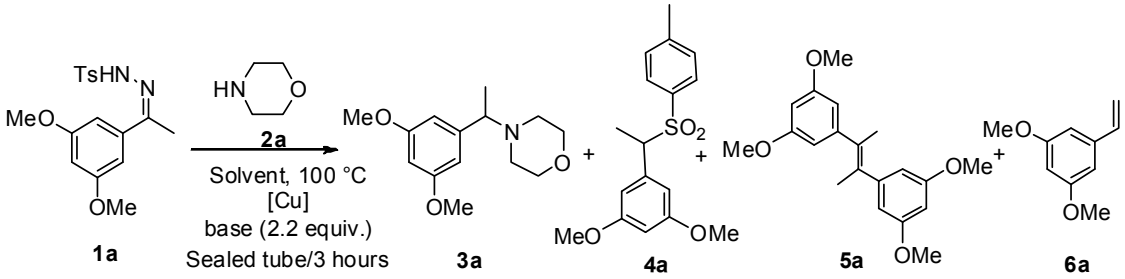
The ketone (20 mmol) was added to an ethanolic solution (30 mL) of *p*-toluenesulfonhydrazide (20 mmol). The reaction mixture was refluxed for 2-6 h. Then the mixture was allowed to cool to room temperature and the product precipitated. The crystalline product was collected by filtration and washed thoroughly with cold ether.

N-Tosylhydrazones **1c, 1d** and **1e** derived from carbonyl compounds were prepared following the procedure described by V. K. Aggarwal and al.[2]



White solid (86 % yield); mp: 149-150 °C; TLC : R_f = 0.22 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 916, 1035, 1059, 1150, 1198, 1306, 1325, 1363, 1421, 1458, 1458, 1585, 2159, 3155; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.34 (s, 1H), 7.94 (d, *J* = 8.1 Hz, 2H), 7.29 (d, *J* = 8.1 Hz, 2H), 6.77 (d, *J* = 1.7 Hz, 2H), 6.43 (s, 1H), 3.77 (s, 6H), 2.39 (s, 3H), 2.12 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 160.6 (2C), 152.3 (C), 144.2 (C), 139.2 (C), 135.4 (C), 129.5 (2CH), 128.2 (2CH), 104.6 (2CH), 101.6 (CH), 55.4 ($2CH_3$), 21.6 (CH_3), 13.5 (CH_3); MS (ESI) : 349.1 ($M + H^+$); Anal. calcd for $C_{17}H_{20}N_2O_4S$: C 58.60, H 5.79, N 8.04 found: C 58.70, H 5.48, N 7.98.

Table for Optimizing Reaction Conditions



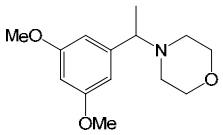
Entry	Solvent	Base	[Cu] (0.1 equiv.)	Ratio ^{1}H NMR **3/4/5/6 %**	Yield of **3a**[a]	
1	1,4-Dioxane	Cs_2CO_3	**none**	nd[b]		Effect of copper source
2	1,4-Dioxane	Cs_2CO_3	**$Cu(OAc)_2$ anh.**	67/15/16/2		
3	1,4-Dioxane	Cs_2CO_3	**$Cu(OAc)_2,H_2O$**	67/19/10/4		
4	1,4-Dioxane	Cs_2CO_3	**$CuBr_2$**	68/18/12/2		
5	1,4-Dioxane	Cs_2CO_3	**CuTc**	69/17/10/4		
6	1,4-Dioxane	Cs_2CO_3	**CuI**	72/16/7/5		
7	1,4-Dioxane	Cs_2CO_3	**CuO**	74/11/10/5		
8	1,4-Dioxane	Cs_2CO_3	**Cu(0)**	nd[b]		
9	**1,4-Dioxane**	**Cs_2CO_3**	**$Cu(acac)_2$**	**91/7/0/2**	**80 %**[c]	
10	1,4-Dioxane	Cs_2CO_3	**$Cu(acac)_2$**	80/15/0/5	71 %[d]	
11	**THF**	Cs_2CO_3	$Cu(acac)_2$	82/7/8/3	68 **%**	Effect of solvents
12	**Toluene**	Cs_2CO_3	$Cu(acac)_2$	82/3/12/3	71 **%**	
13	**DME**	Cs_2CO_3	$Cu(acac)_2$	88/7/3/2	73 **%**	
14	**ACN**	Cs_2CO_3	$Cu(acac)_2$	77/15/4/4	65 %	
15	**4-fluorobenzene**	Cs_2CO_3	$Cu(acac)_2$	nd[b]		
16	1,4-Dioxane	Cs_2CO_3 1 equiv.	$Cu(acac)_2$	50/35/0/5[e]	25 %	Effect of bases
17	1,4-Dioxane	Cs_2CO_3 1.5 equiv.	$Cu(acac)_2$	80/10/0/5[f]	60 %	
18	1,4-Dioxane	**K_2CO_3**	$Cu(acac)_2$	60/20/15/5		
19	1,4-Dioxane	**LiOtBu**	$Cu(acac)_2$	70/14/10/6		
20	1,4-Dioxane	**NaOt-tBu**	$Cu(acac)_2$	56/16/22/6		
21	1,4-Dioxane	**KOt-tBu**	$Cu(acac)_2$	61/18/15/6		
22	1,4-Dioxane	**CsOH**	$Cu(acac)_2$	30/10/50/10		
23	1,4-Dioxane	**K_3PO_4**	$Cu(acac)_2$	46/21/30/3		
24	1,4-Dioxane	**none**	$Cu(acac)_2$	nd[b]		

[a] Isolated yield of **3a**. [b] nd = not determined (NMR of crude reaction was not exploitable). [c] Only traces of 3a were detected by NMR when carrying out the reaction at 80 °C. [d] reaction was performed at atmospheric pressure. [e] 10% of **1a** was observed by NMR of crude reaction. [f] 5 % of **1a** was observed by NMR of crude reaction.

Typical Procedure for the Copper-Catalyzed Coupling of tosylhydrazones with amines reagents

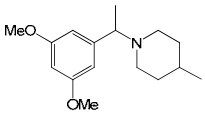
A mixture of tosylhydrazone **1** (0.25 mmol), amines **2** (0.5 mmol, 2.0 equiv), $Cu(acac)_2$ 10 mol % and Cs_2CO_3 (0.9 mmol, 2.2 equiv) in dioxane (2.5 mL) is stirred at 100 °C for 3 h in a sealed tube. After completion of the reaction, as indicated by TLC, the mixture is cooled to room temperature. AcOEt was added to the mixture, which was filtered through *celite*. The solvents were evaporated under reduced pressure and the crude residue was purified by flash chromatography on silica gel.

Compounds characterizations



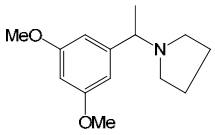
4-(1-(3,5-dimethoxyphenyl)ethyl)morpholine (3a)

Colorless oil (80 % yield). TLC : R_f = 0.16 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2802, 1610, 1595, 1470, 1455, 1428, 1346, 1292, 1266, 1245, 1205, 1154, 1118, 1068, 1049, 1017, 960, 925, 869, 862, 845, 790, 701 cm^{-1}; ^1H NMR (300 MHz, Acetone) δ 6.53 (d, *J* = 2.3 Hz, 2H), 6.37 (t, *J* = 2.3 Hz, 1H), 3.78 (s, 6H), 3.60 (t, *J* = 4.7 Hz, 4H), 3.21 (q, *J* = 6.6 Hz, 1H), 2.54 – 2.23 (m, 4H), 1.29 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, Acetone) δ = 160.95 (2C), 147.08 (C), 105.28 (2CH), 98.29 (CH), 66.77 ($2CH_2$), 65.28 (CH), 54.57 (2CH), 51.29 ($2CH_2$), 19.54 (CH_3); MS (ESI) : 252.2 ($M + H^+$), 274.1 ($M + Na^+$); Anal. calcd for $C_{14}H_{21}NO_3$: C 66.91, H 8.42, N 5.57 found: C 66.87, H 8.39, N 5.53.



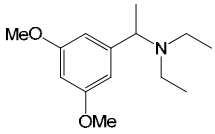
1-(1-(3,5-dimethoxyphenyl)ethyl)-4-methylpiperidine (3b)

Colorless oil (75 % yield). R_f = 0.30 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2915, 2838, 2800, 1610, 1595, 1458, 1427, 1337, 1290, 1258, 1205, 1153, 1086, 1069, 1053, 926, 846, 701, 668 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.49 (d, *J* = 2.1 Hz, 2H), 6.34 (t, *J* = 2.1 Hz, 1H), 3.79 (s, 6H), 3.42 – 3.20 (m, 1H), 3.10 – 2.96 (m, 1H), 2.85 – 2.69 (m, 1H), 2.02 – 1.46 (m, 7H), 1.35 (d, *J* = 6.6 Hz, 3H), 0.91 – 0.87 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.7 (2C), 147.3 (C), 105.9 (2CH), 98.6 (CH), 65.5 (CH), 55.5 (2CH), 51.4 (CH_2), 51.2 (CH_2), 34.7 ($2CH_2$), 31.0 (CH), 22.1 (CH_3), 20.0 (CH_3); MS (ESI) : 264.2 ($M + H^+$); Anal. calcd for $C_{16}H_{25}NO_2$: C 72.96, H 9.57, N 5.32 found: C 72.90, H 9.53, N 5.27.



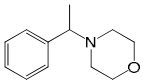
1-(1-(3,5-dimethoxyphenyl)ethyl)pyrrolidine (3c)

Colorless oil (82 % yield). TLC : R_f = 0.25 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2970, 2935, 2873, 2835, 1609, 1594, 1455, 1427, 1366, 1344, 1321, 1290, 1246, 1204, 1152, 1132, 1083, 1062, 1049, 1028, 980, 927, 904, 843, 829, 701, 640 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.52 (d, *J* = 1.8 Hz, 2H), 6.34 (t, *J* = 1.8 Hz, 1H), 3.78 (s, 6H), 3.11 (q, *J* = 6.4 Hz, 1H), 2.63 – 2.34 (m, 4H), 1.88 – 1.64 (m, 4H), 1.39 (d, *J* = 6.4 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.8 (2C), 148.0 (C), 105.2 (2CH), 99.0 (CH), 66.6 (CH), 55.5 ($2CH_3$), 53.2 ($2CH_2$), 23.6 ($2CH_2$), 23.3 (CH_3); MS (ESI) : 236.2 (M+ H^+); Anal. calcd for $C_{14}H_{21}NO_2$: C 71,46 H 8.99, N 5.95 found: C 71.40, H 8.85, N 5.91.



1-(3,5-dimethoxyphenyl)-N,N-diethylethanamine (3d)

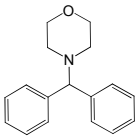
Colorless oil (55 % yield). TLC : R_f = 0.25 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2969, 2835, 1610, 1594, 1458, 1426, 1344, 1289, 1204, 1150, 1054, 1008, 925, 846, 701, 676 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.57 (d, *J* = 2.3 Hz, 2H), 6.34 (t, *J* = 2.3 Hz, 1H), 3.79 (s, 6H), 3.71 (q, *J* = 6.6 Hz, 1H), 2.66 – 2.49 (m, 4H), 1.33 (d, *J* = 6.6 Hz, 3H), 1.00 (t, *J* = 7.1 Hz, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.7 (2C), 148.3 (C), 105.7 (2CH), 98.7 (CH), 59.9 (CH), 55.5 ($2CH_3$), 43.0 ($2CH_2$), 18.9 ($2CH_3$), 11.9 (CH_3); MS (ESI) : 238.1 (M+ H^+); Anal. calcd for $C_{14}H_{23}NO_2$: C 70.85, H 9.77, N 5.90, found: C 70.71, H 9.63, N 5.85.



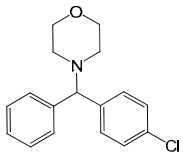
4-(1-phenylethyl)morpholine (3e) has been previously reported[3]

Colorless oil (67 % yield). TLC : R_f = 0.25 (EtOAc/Cyclohexane, 3/7, SiO_2);

4-benzhydrylmorpholine (3f)

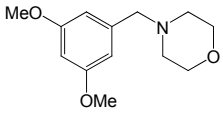


White solid (84 % yield), mp: 76–78 °C. TLC : R_f = 0.25 (EtOAc/Cyclohexane, 5/95, SiO_2); IR (neat) 2957, 2853, 2809, 1492, 1450, 1278, 1118, 1075, 1032, 1009, 876, 801, 759, 707, 668 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.52 – 7.34 (m, 4H), 7.33 – 7.22 (m, 4H), 7.22 – 7.12 (m, 2H), 4.20 (s, 1H), 3.83 – 3.58 (m, 4H), 2.61-2.20 (m, 4H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 142.5 (2C), 128.7 (4CH), 128.1 (4CH), 127.2 (2CH), 76.8 (CH), 67.4 ($2CH_2$), 52.8 ($2CH_2$); MS (ESI): 254.1 (M + H^+); Anal. calcd for $C_{17}H_{19}NO$: C 80.60, H 7.56, N 5.53 found: C 80.54, H 7.43, N 5.49.



4-((4-chlorophenyl)(phenyl)methyl)morpholine (3g) has been previously reported [4]

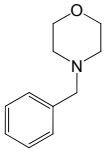
Colorless oil (40 % yield), R_f = 0.25 (EtOAc/Cyclohexane, 5/95, SiO_2);



4-(3,5-dimethoxybenzyl)morpholine (3h)

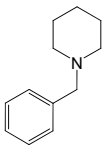
Colorless oil (61 % yield). TLC : R_f = 0.60 (EtOAc/Cyclohexane, 5/5, SiO_2); IR (neat) 2808, 1608, 1594, 1472, 1454, 1428, 1397, 1350, 1332, 1318, 1293, 1274, 1204, 1156, 1147, 1113, 1067, 1054, 1035, 1009, 993, 926, 907, 865, 836, 769 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.53 – 6.48 (m, 2H), 6.40 – 6.30 (m, 1H), 3.79 (s, 6H), 3.73 – 3.68 (m, 4H), 3.43 (s, 2H), 2.50 – 2.36 (m, 4H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.9 (2C), 140.5 (C), 107.1 (2CH), 99.2 (CH), 67.2 ($2CH_2$), 63.6 (CH_2), 55.4 ($2CH_3$), 53.8 ($2CH_2$); MS (ESI): 238.1 ($M + H^+$); Anal. calcd for $C_{13}H_{19}NO_3$: C 65.80, H 8.07, N 5.90 found: C 65.72, H 8.01, N 5.87.

4-benzylmorpholine (3i) has been previously reported[5]

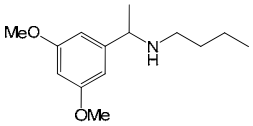


Colorless oil (71 % yield). TLC : R_f = 0.2 (EtOAc/Cyclohexane, 5/5, SiO_2); ^1H NMR (300 MHz, $CDCl_3$) δ 7.66 – 7.07 (m, 5H), 3.80 – 3.66 (m, 4H), 3.50 (s, 2H), 2.48 – 2.40 (m, 4H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 137.9 (C), 129.3 (2CH), 128.4 (2CH), 127.3 (CH), 67.2 ($2CH_2$), 63.6 (CH_2), 53.8 ($2CH_2$).

1-benzylpiperidine (3j) has been previously reported[6]



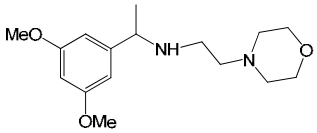
Colorless oil (60 % yield). TLC : R_f = 0.30 (EtOAc/Cyclohexane, 5/5, SiO_2); ^1H NMR (300 MHz, $CDCl_3$) δ 7.61 – 7.02 (m, 5H), 3.48 (s, 2H), 2.38 (br s, 4H), 1.65 – 1.48 (m, 4H), 1.49 – 1.37 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 138.7 (C), 129.4 (2CH), 128.2 (2CH), 127.0 (CH), 64.1 (CH_2), 54.6 ($2CH_2$), 26.1 ($2CH_2$), 24.5 (CH_2).



N-(1-(3,5-dimethoxyphenyl)ethyl)butan-1-amine (3k)

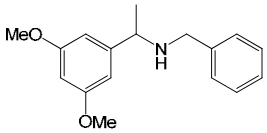
Colorless oil (50 % yield). TLC : R_f = 0.20 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2956, 2926, 2837, 1610, 1595, 1466, 1459, 1428, 1344, 1292, 1204, 1154, 1055, 927, 845, 830, 698, 618 cm^{-1}; ^1H NMR (300 MHz, Acetone) δ 6.56 (d, *J* = 2.3 Hz, 2H), 6.34 (t, *J* = 2.3 Hz, 1H), 3.77 (s, 6H), 3.67 (q, *J* = 6.5 Hz, 1H), 2.58 – 2.29 (m, 2H), 1.99

– 1.81 (m, 1H), 1.49 – 1.29 (m, 4H), 1.26 (d, *J* = 6.6 Hz, 3H), 0.87 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (75 MHz, Acetone) δ = 162.0 (2C), 150.6 (C), 105.3 (2CH), 99.2 (CH), 59.6 (CH), 55.6 ($2CH_3$), 48.3 (CH_2), 33.5 (CH_2), 25.3 (CH_3), 21.3 (CH_2), 14.5 (CH_3). MS (ESI) : 238.1 (M+ H^+), 252.1 (M + Na^+); Anal. calcd for $C_{14}H_{23}NO_2$: C 70.85, H 9.77, N 5.90, found: C 70.78, H 9.72, N 5.88.



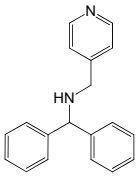
1-(3,5-dimethoxyphenyl)-N-(2-morpholinoethyl)ethanamine (3l)

Colorless oil (62 % yield). TLC : R_f = 0.25 (EtOAc/MeOH, 9/1, SiO_2); IR (neat) 2961, 2809, 2688, 1609, 1594, 1468, 1455, 1428, 1351, 1292, 1273, 1204, 1152, 1115, 1065, 1052, 1008, 942, 914, 866, 842, 762, 700, 661; ^{1}H NMR (300 MHz, $CDCl_3$) δ 6.47 (d, *J* = 2.3 Hz, 2H), 6.34 (t, *J* = 2.3 Hz, 1H), 3.78 (s, 6H), 3.73 – 3.65 (m, 5H), 2.68 – 2.20 (m, 9H), 1.37 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 161.1(2C), 148.2 (C), 104.7 (2CH), 98.8 (CH), 67.1 ($2CH_2$), 58.9 (CH), 58.2 (CH_2), 55.5 ($2CH_3$), 53.8 ($2CH_2$), 43.8 (CH_2), 24.2 (CH_3); MS (ESI) : 295.2 (M+ H^+), 317.2 (M + Na^+); Anal. calcd for $C_{16}H_{26}N_2O_3$: C 65.28, H 8.90, N 9.52 found: C 65.19, H 8.85, N 9.48.



N-benzyl-1-(3,5-dimethoxyphenyl)ethanamine (3m)

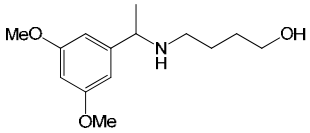
Colorless oil (53 % yield). TLC : R_f = 0.25 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2938, 2837, 1609, 1594, 1464, 1454, 1428, 1345, 1291, 1204, 1152, 1122, 1054, 904, 833, 731, 697, 649 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.44 – 7.16 (m, 5H), 6.55 (d, *J* = 2.3 Hz, 2H), 6.37 (t, *J* = 2.3 Hz, 1H), 3.81 (s, 6H), 3.78 – 3.56 (m, 3H), 1.63 (br, 1H), 1.36 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 161.1 (2C), 148.4 (C), 140.6 (C), 128.5 (2CH), 128.3 (2CH), 127.0 (CH), 104.7 (2CH), 99.0 (CH), 57.9 (CH), 55.5 ($2CH_3$), 51.8 (CH_2), 24.6 (CH_3); MS (ESI) : 272.2 (M + H^+); Anal. calcd for $C_{17}H_{21}NO_2$: C 75.25, H 7.80, N 5.16 found: C 75.20, H 7.75, N 5.14.



1,1-diphenyl-N-(pyridin-4-ylmethyl)methanamine (3n)

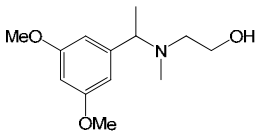
Yellow oil (42 % yield). TLC : R_f = 0.20 (EtOAc/Cyclohexane, 5/5, SiO_2); IR (neat) 3025, 1599, 1561, 1492, 1453, 1413, 1318, 1289, 1220, 1157, 1077, 1066, 1029, 993, 798, 744, 704, 695 cm^{-1}; ^{1}H NMR (200 MHz, $CDCl_3$) δ 7.99 – 6.76 (m, 14H), 4.94 (s, 1H), 3.81 (s, 2H), 2.60 – 1.69 (br, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 150.6 (C), 149.6 (2CH), 143.3 (2C), 130.0 (2CH), 128.6 (4CH), 128.3 (2CH), 127.3 (4CH), 66.5 (CH), 50.5 (CH_2); MS (ESI):

275.1 (M + H^+); Anal. calcd for $C_{19}H_{18}N_2$: C 83.18, H 6.61, N 10.21 found: C 83.02, H 6.53, N 10.03.



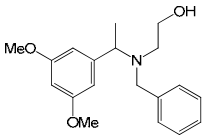
4-(1-(3,5-dimethoxyphenyl)ethylamino)butan-1-ol (3p)

Colorless oil (60 % yield). TLC : R_f = 0.2 (EtOAc/MeOH, 10/2, SiO_2); IR (neat) 3304, 2935, 2837, 1610, 1594, 1460, 1428, 1345, 1292, 1204, 1151, 1116,1052, 924, 843, 834,699 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.47 (d, *J* = 2.1 Hz, 2H), 6.36 (t, *J* = 2.1 Hz, 1H), 3.80 (s, 6H), 3.71 (q, *J* = 6.6 Hz, 1H), 3.60 (t, *J* = 5.0 Hz, 2H), 3.30 (brs, 1H), 2.53 (t, *J* = 5.0 Hz, 2H), 1.75 – 1.47 (m, 4H), 1.41 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 161.2 (2C), 146.7 (C), 104.7 (2CH), 99.2 (CH), 62.8 (CH_2), 58.8 (CH), 55.5 (2CH), 47.5 (CH_2), 32.3 (CH_2), 28.5 (CH_2), 23.5 (CH_3); MS (ESI): 254.2 (M + H^+); Anal. calcd for $C_{14}H_{23}NO_3$: C 66.37, H 9.15, N 5.53 found: C 66.25, H 9.10, N 5.50.



2-((1-(3,5-dimethoxyphenyl)ethyl)(methyl)amino)ethanol (3q)

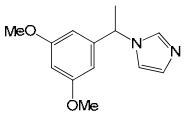
Colorless oil (84 % yield). TLC : R_f = 0.25 (EtOAc/MeOH, 9/1, SiO_2); IR (neat) 3429, 2936, 1608, 1594, 1454, 1428, 1400, 1342, 1307, 1292, 1204, 1149, 1081, 1062, 1050, 1021, 994, 969, 941, 925, 844, 781, 719, 701, 673, 664, 642 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 6.45 (d, *J* = 1.6 Hz, 2H), 6.35 (t, *J* = 1.6 Hz, 1H), 3.77 (s, 6H), 3.67 – 3.41 (m, 3H), 2.89 – 2.34 (m, 3H), 2.21 (s, 3H), 1.36 (d, *J* = 6.8 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.8 (2C), 145.7 (C), 106.0 (2CH), 98.8 (CH), 63.9 (CH), 58.4 (CH_2), 55.4 ($2CH_3$), 55.2 (CH_2), 37.7 (CH_2), 17.8 (CH_2); MS (ESI): 240.1 (M + H^+); Anal. calcd for $C_{13}H_{21}NO_3$: C 65.25, H 8.84, N 5.85 found: C 65.12, H 8.78, N 5.78.



2-(benzyl(1-(3,5-dimethoxyphenyl)ethyl)amino)ethanol (3r)

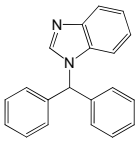
Colorless oil (61 % yield). TLC : R_f = 0.3 (EtOAc/MeOH,9/1, SiO_2); IR (neat) 2936, 1684, 1596, 1456, 1429, 1205, 1156, 1047, 903, 778, 728, 717, 650 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.52 – 7.02 (m, 5H), 6.47 (d, *J* = 2.0 Hz, 2H), 6.36 (t, *J* = 2.0 Hz, 1H), 4.01 – 3.31 (m, 11H), 2.87 – 2.46 (m, 2H), 1.40 (d, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 160.8 (2C), 145.1 (C), 140.0 (C), 128.9 (2CH), 128.6 (2CH), 127.3 (CH), 106.4 (2CH), 98.7 (CH), 58.8 (CH_2), 57.9 (CH), 55.4 ($2CH_3$), 54.8 (CH_2), 51.0 (CH_2), 14.9 (CH_3); MS (ESI):

316.2 (M + H^+); Anal. calcd for $C_{19}H_{25}NO_3$: C 72.35, H 7.99, N 4.44 found: C 72.28, H 7.90, N 4.39.



1-(1-(3,5-dimethoxyphenyl)ethyl)-1H-imidazole (3s)

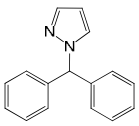
Colorless oil (65 % yield). TLC : R_f = 0.30 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 2936, 1610, 1598, 1497, 1477, 1454, 1429, 1347, 1323, 1294, 1224, 1206, 1163, 1155, 1112, 1072, 1053, 1047, 1023, 983, 903, 847, 834, 818, 738, 726, 720, 714, 694 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.63 (s, 1H), 7.09 (s, 1H), 6.95 (s, 1H), 6.38 (t, *J* = 2.1 Hz, 1H), 6.28 (d, *J* = 2.1 Hz, 2H), 5.27 (q, *J* = 7.1 Hz, 1H), 3.75 (s, 6H), 1.84 (d, *J* = 7.1 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 161.4 (2C), 143.9 (C), 129.1 (CH), 118.2 (CH), 110.2 (CH), 104.5 (2CH), 99.6 (CH), 56.9 (CH), 55.5 ($2CH_3$), 22.1 (CH_3); MS (APCI) : 233.1 (M + H^+); Anal. calcd for $C_{13}H_{16}N_2O_2$: C 67.22, H 6.94, N 12.06 found: C 67.18, H 6.91, N 12.0.



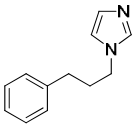
1-benzhydryl-1H-benzo[d]imidazole (3t)

White solid (64 % yield), mp: 160–162 °C. TLC : R_f = 0.25 (EtOAc/Cyclohexane, 5/95, SiO_2); IR (neat) 2957, 1496, 1478, 1450, 1281, 1218, 1031, 903, 775, 726 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.84 (d, *J* = 8.0 Hz, 1H), 7.63 (s, 1H), 7.47 – 7.06 (m, 13H), 6.76 (s, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 144.0 (CH), 142.7 (C), 138.2 (2C), 134.2 (C), 129.2 (4CH), 128.7 (2CH), 128.3 (4CH), 123.2 (CH), 122.6 (CH), 120.5 (CH), 110.9 (CH), 63.8 (CH); MS (ESI): 285.1 (M + H^+); Anal. calcd for $C_{20}H_{16}N_2$: C 84.48, H 5.67, N 9.85 found: C 84.33, H 5.55, N 9.80.

1-benzhydryl-1H-pyrazole (3u)

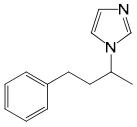


White solid (70 % yield), mp: 61–63 °C. TLC : R_f = 0.60 (EtOAc/Cyclohexane, 3/7, SiO_2); IR (neat) 1493, 1448, 1440, 1397, 1349, 1315, 1297, 1283, 1264, 1184, 1091, 1079, 1053, 1044, 1032, 969, 918, 866, 841, 817, 751, 743, 726, 705, 701 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.63 (s, 1H), 7.47 – 7.20 (m, 7H), 7.18 – 7.00 (m, 4H), 6.81 (s, 1H), 6.30 (s, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 139.9 (CH), 139.7 (2C), 129.7 (CH), 128.8 (4CH), 128.4 (4CH), 128.2 (2CH), 105.7 (CH), 69.6 (CH); MS (ESI): 257.1 (M + Na^+); Anal. calcd for $C_{16}H_{14}N_2$: C 82.02, H 6.02, N 11.96 found: C 81.91, H 5.92, N 11.90.



1-(3-phenylpropyl)-1H-imidazole (3v) has been previously reported[7]

Colorless oil (63 % yield). TLC : R_f = 0.15 (EtOAc, SiO_2); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.46 (s, 1H), 7.41 – 6.99 (m, 6H), 6.93 (s, 1H), 3.93 (t, *J* = 7.5 Hz, 2H), 2.62 (t, *J* = 7.5 Hz, 2H), 2.23 – 2.00 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 140.4 (C), 129.7 (CH), 128.8 (2CH), 128.5 (3CH), 126.5 (CH), 118.8 (CH), 46.3 (CH_2), 32.6 (CH_2), 32.4 (CH_2).



1-(4-phenylbutan-2-yl)-1H-imidazole (3w)

Colorless oil (40 % yield). TLC : R_f = 0.15 (EtOAc, SiO_2); IR (neat) 3027, 2974, 1604, 1495, 1454, 1409, 1225, 1112, 1075, 907, 813, 747, 701, 664 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.50 (s, 1H), 7.35 – 7.15 (m, 4H), 7.10 (d, *J* = 6.4 Hz, 2H), 6.95 (s, 1H), 4.23 – 3.95 (m, 1H), 2.61 – 2.36 (m, 2H), 2.13 – 1.99 (m, 2H), 1.47 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ = 140.6 (C), 136.1 (CH), 129.7 (CH), 128.7 (2CH), 128.4 (2CH), 126.3 (CH), 116.5 (CH), 52.9 (CH), 39.2 (CH_2), 32.2 (CH_2), 22.5 (CH_3); MS (APCI) : 201.1 ($M + H^+$); Anal. calcd for $C_{13}H_{16}N_2$: C 77.96, H 8.05, N 13.99 found: C 77.68, H 8.01, N 13.78.

1. (a) W. R. Bamford and T. S. Stevens, *J. Chem. Soc.*, 1952, 4735-4740; (b) R. H. Shapiro and J. H. Duncan, *Org. Synth.*, 1971, **51**, 66.
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3. (a) M. Utsunomiya and J. F. Hartwig, *J. Am. Chem. Soc.*, 2003, **125**, 14286-14287; (b) M. Kawaguchi, J. Ohashi, Y. Kawakami, Y. Yamamoto and J. Oda, *Synthesis*, 1985, 701-703.
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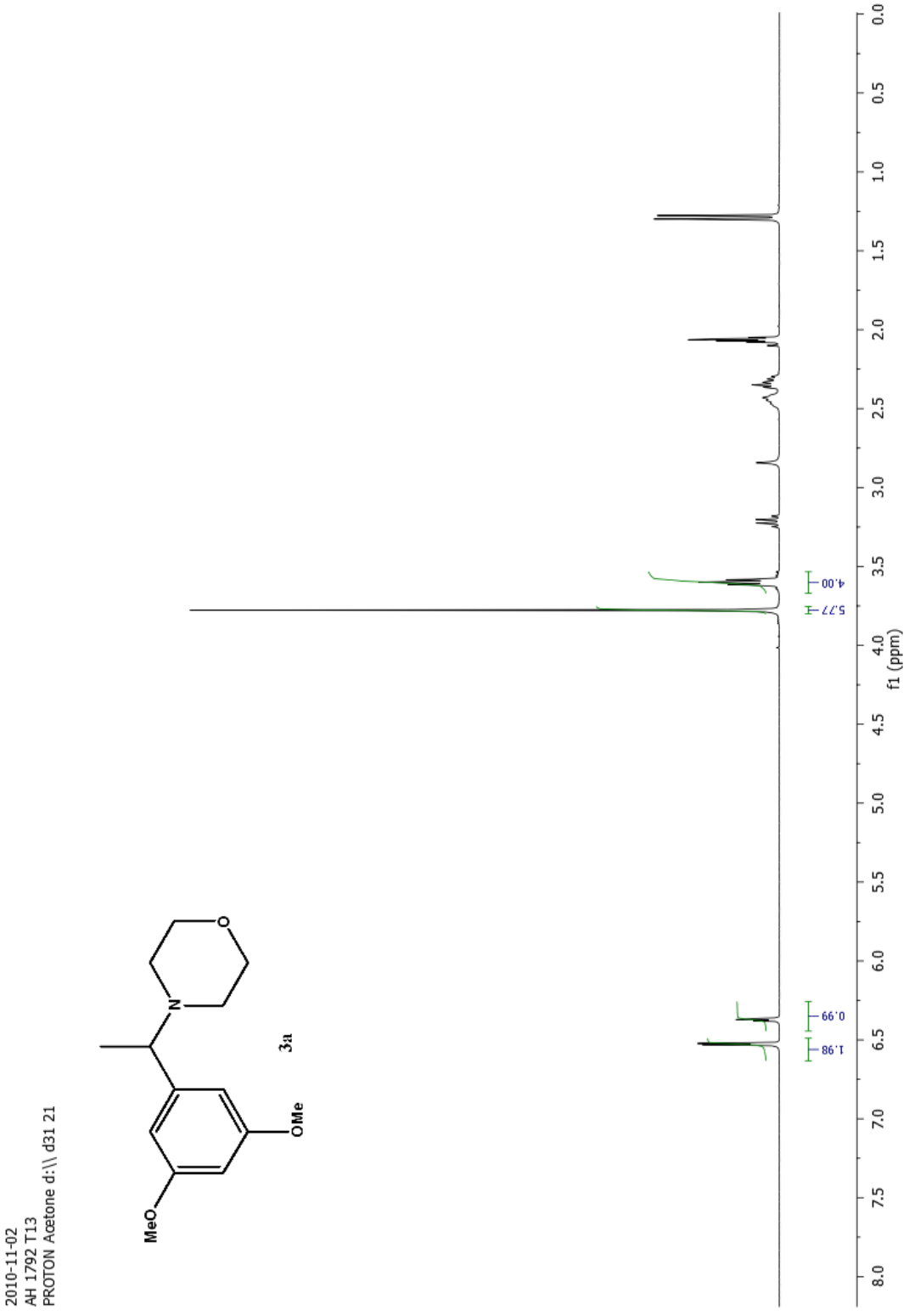
7. C. H. Patel, S. Dhanani, C. P. Owen and S. Ahmed, *Bioorg. Med. Chem. Lett.*, 2006, **16**, 4752-4756.

^{1}H NMR and ^{13}C Spectra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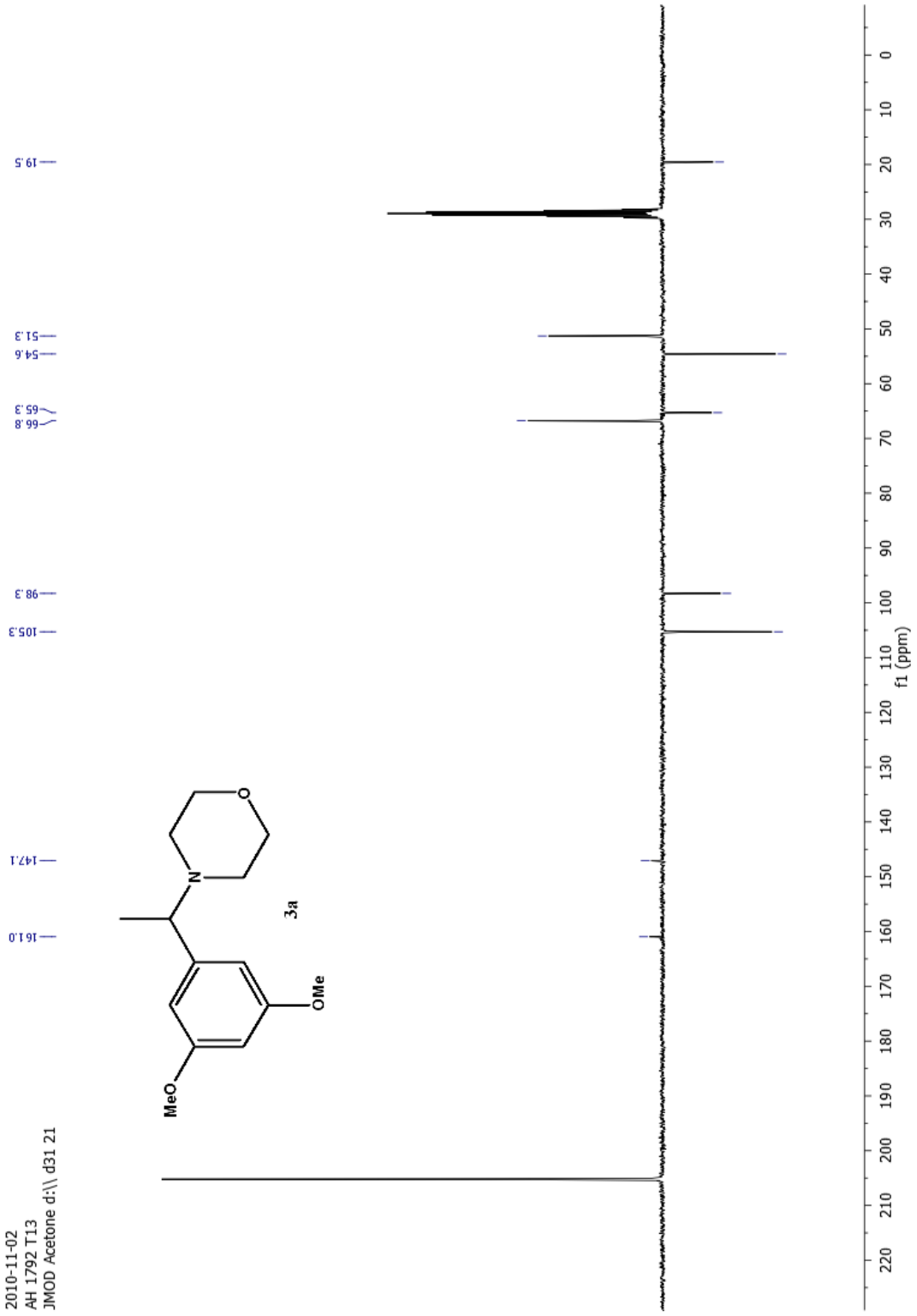

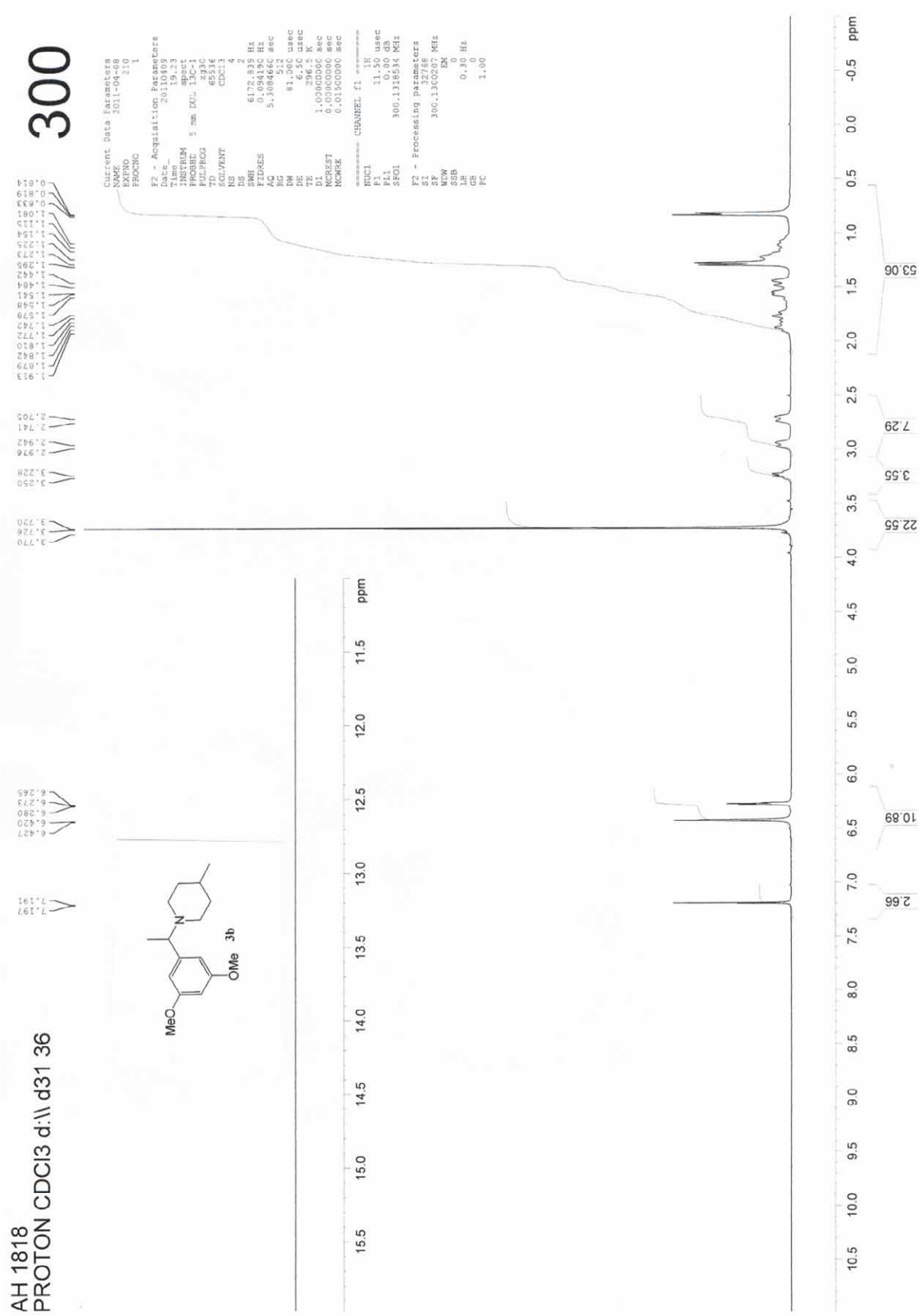
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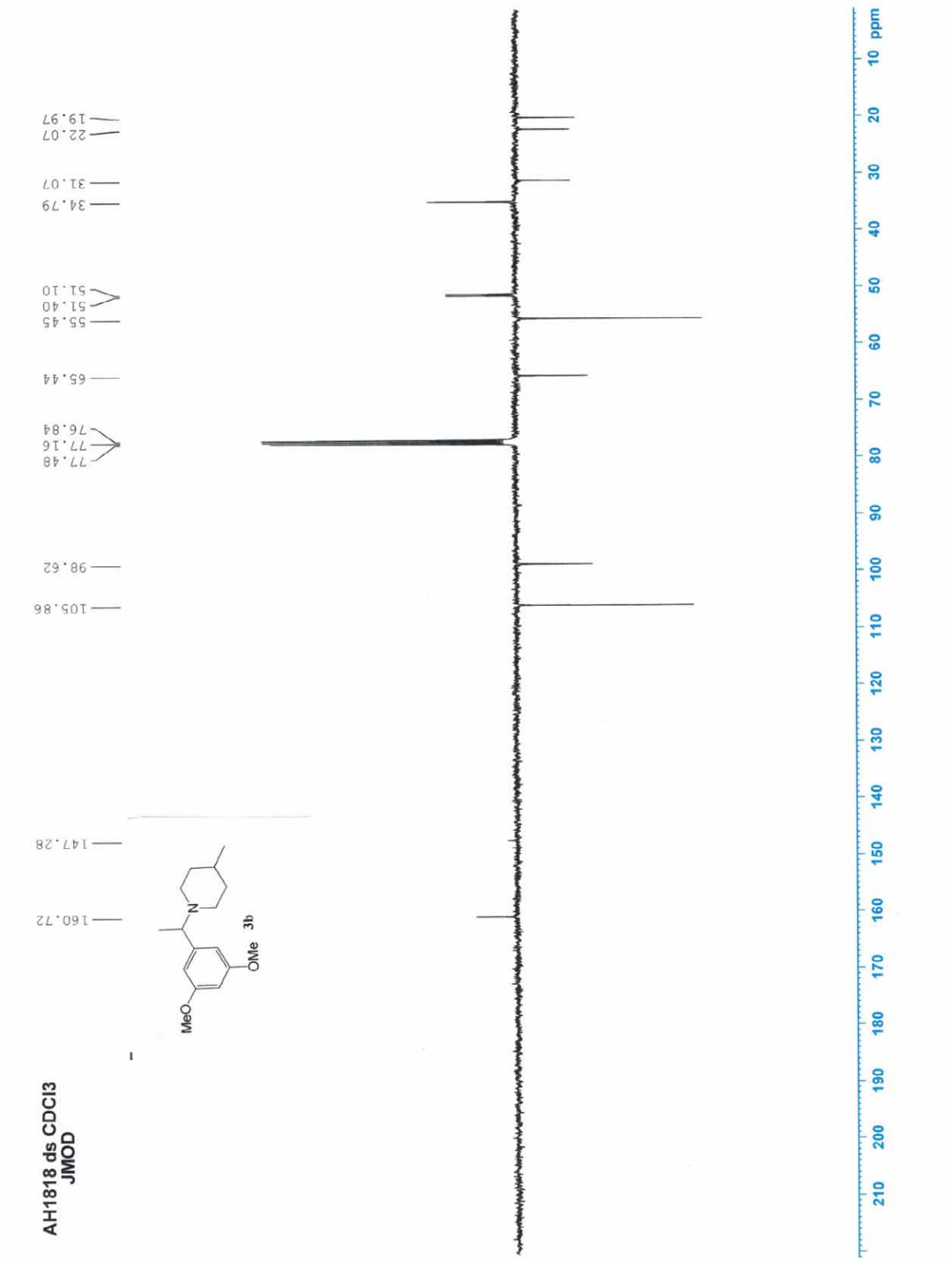

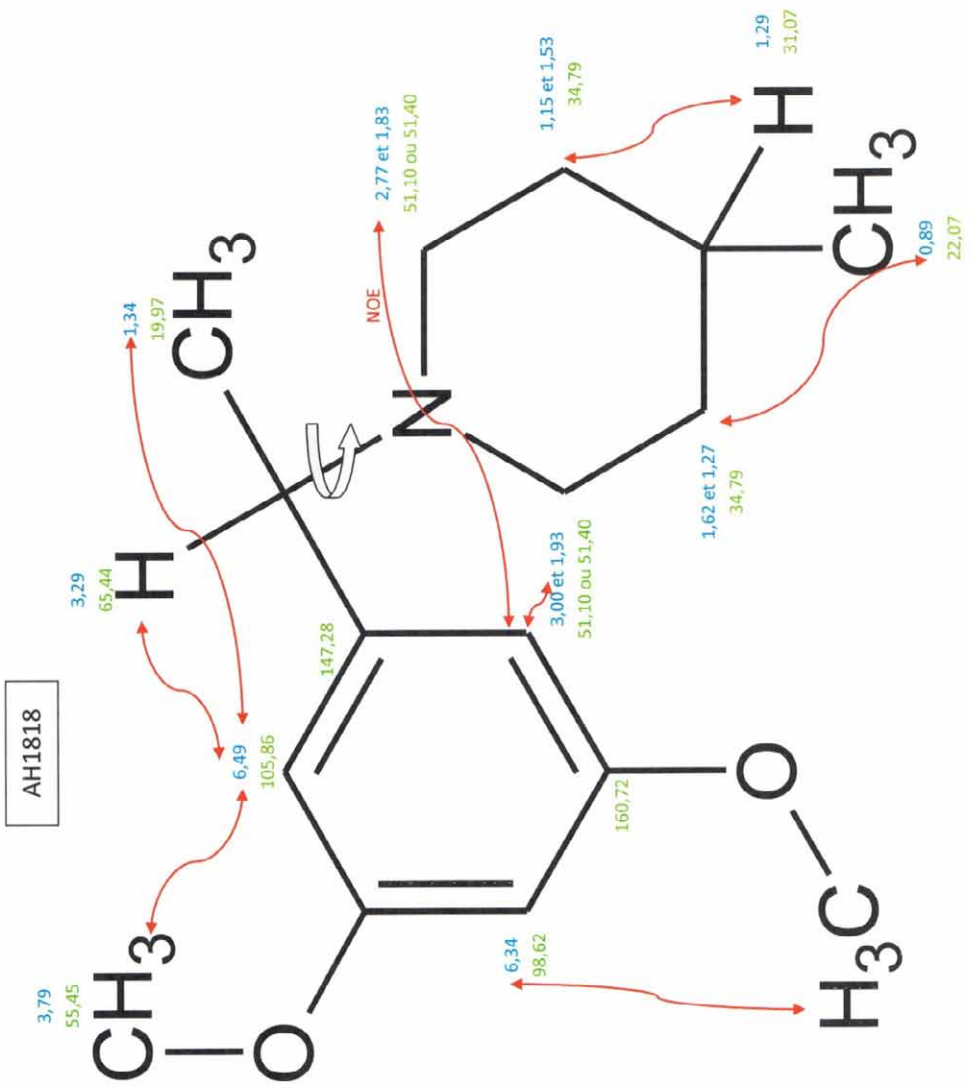
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3,00 et 1,93
51,10 ou 51,40
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31,07
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1,62 et 1,27
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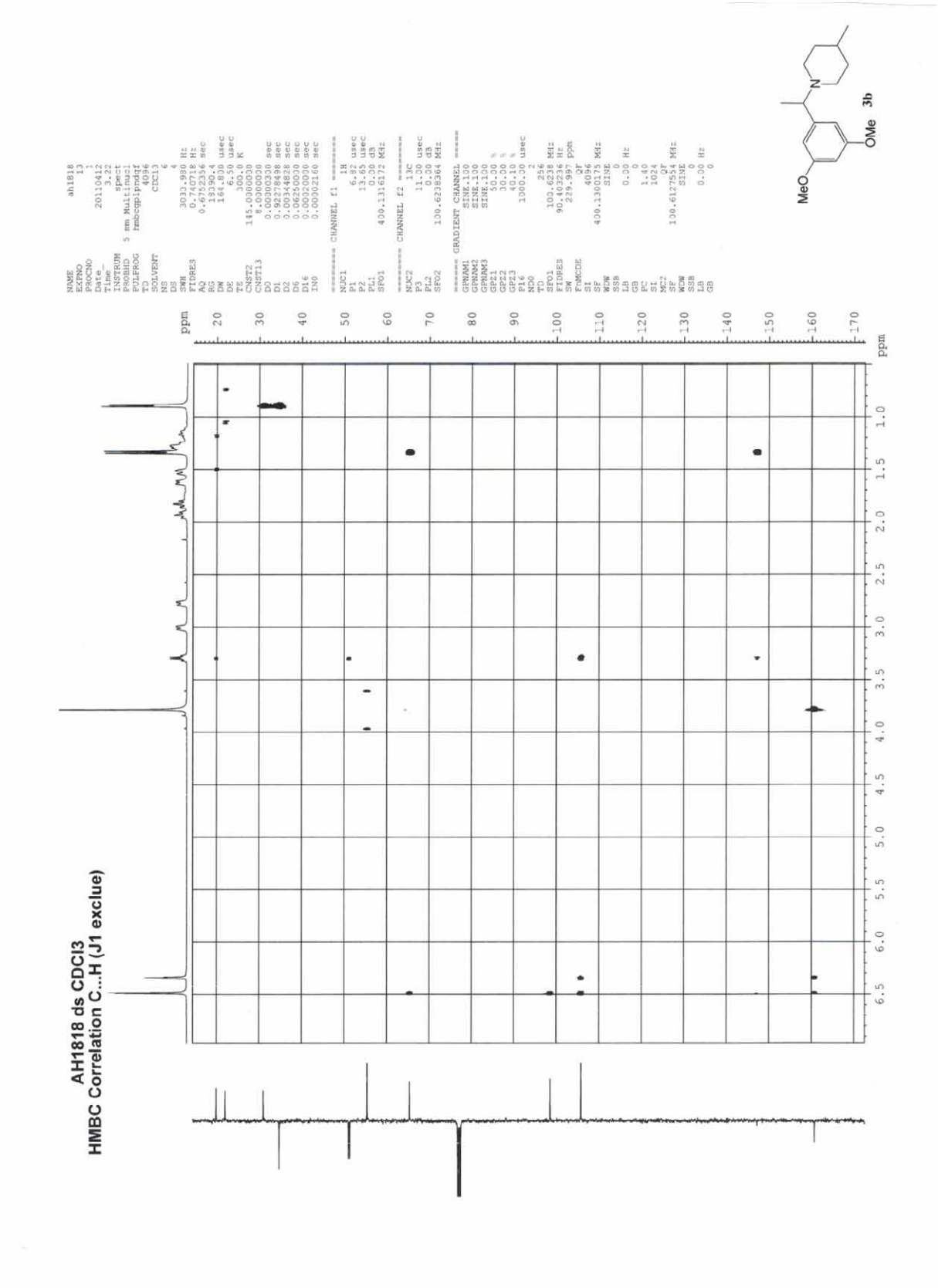
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HMBC Correlation C...H (J1 exclue)
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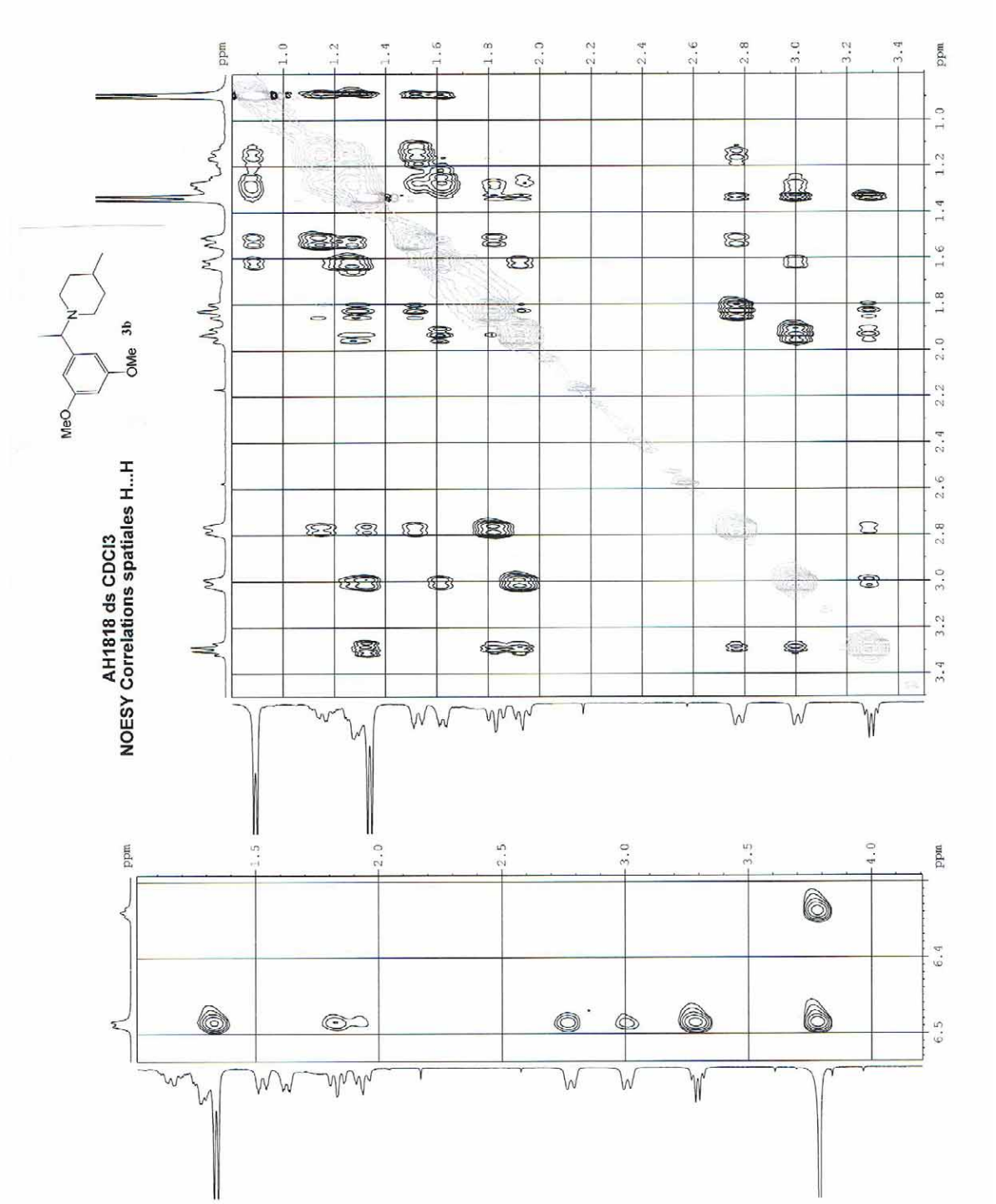
OMe
3b
ppm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MeO
OMe
3b
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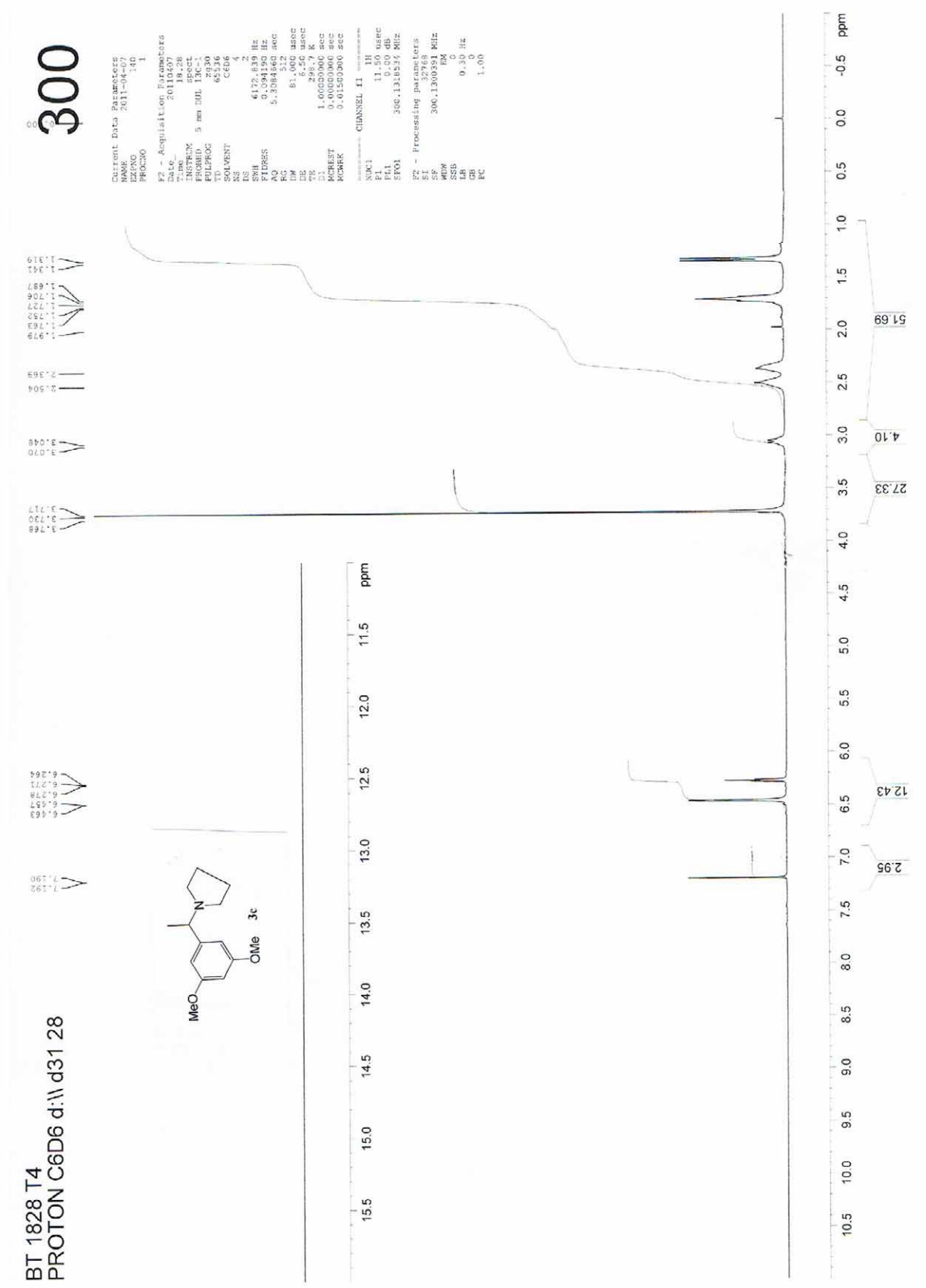
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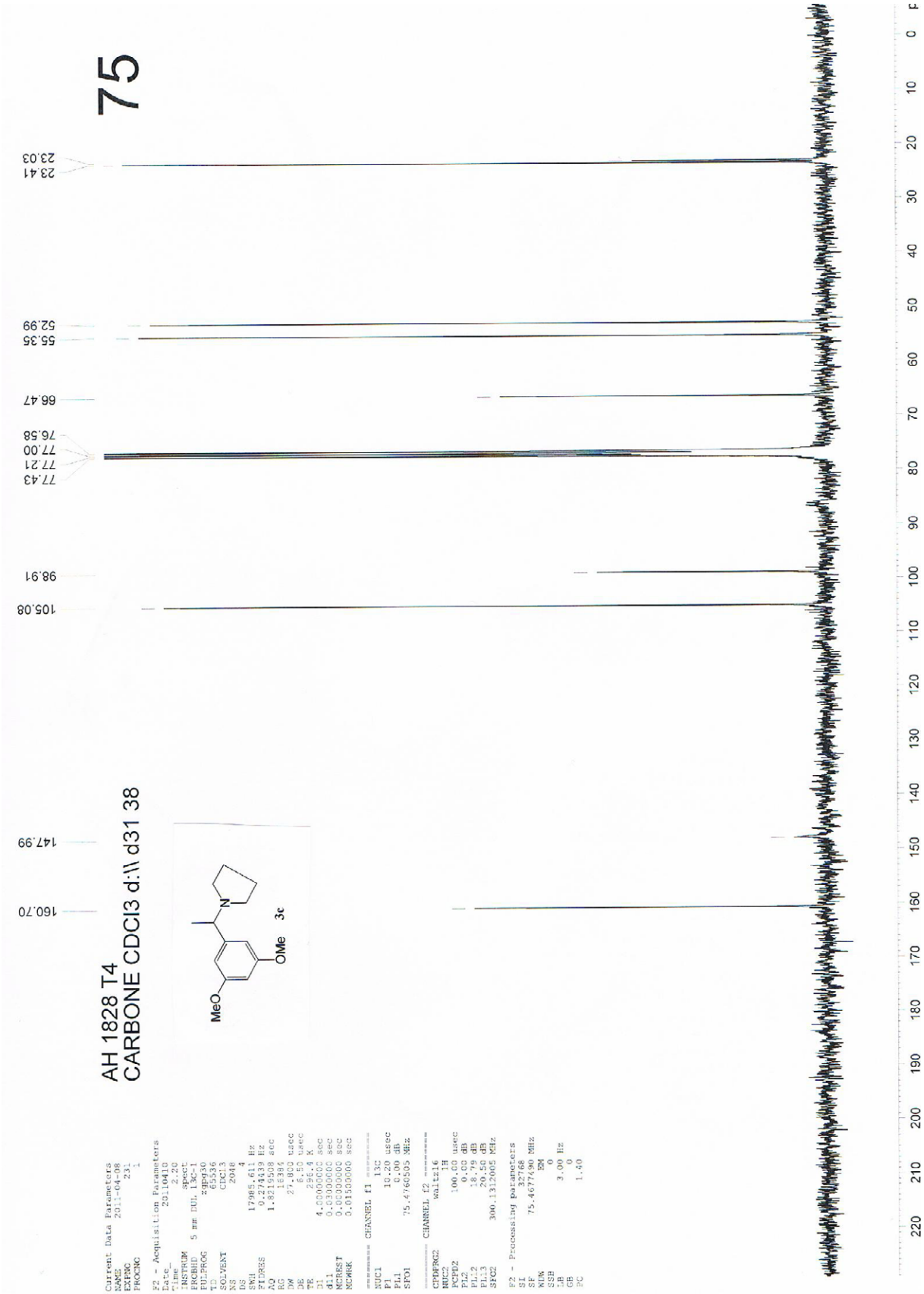
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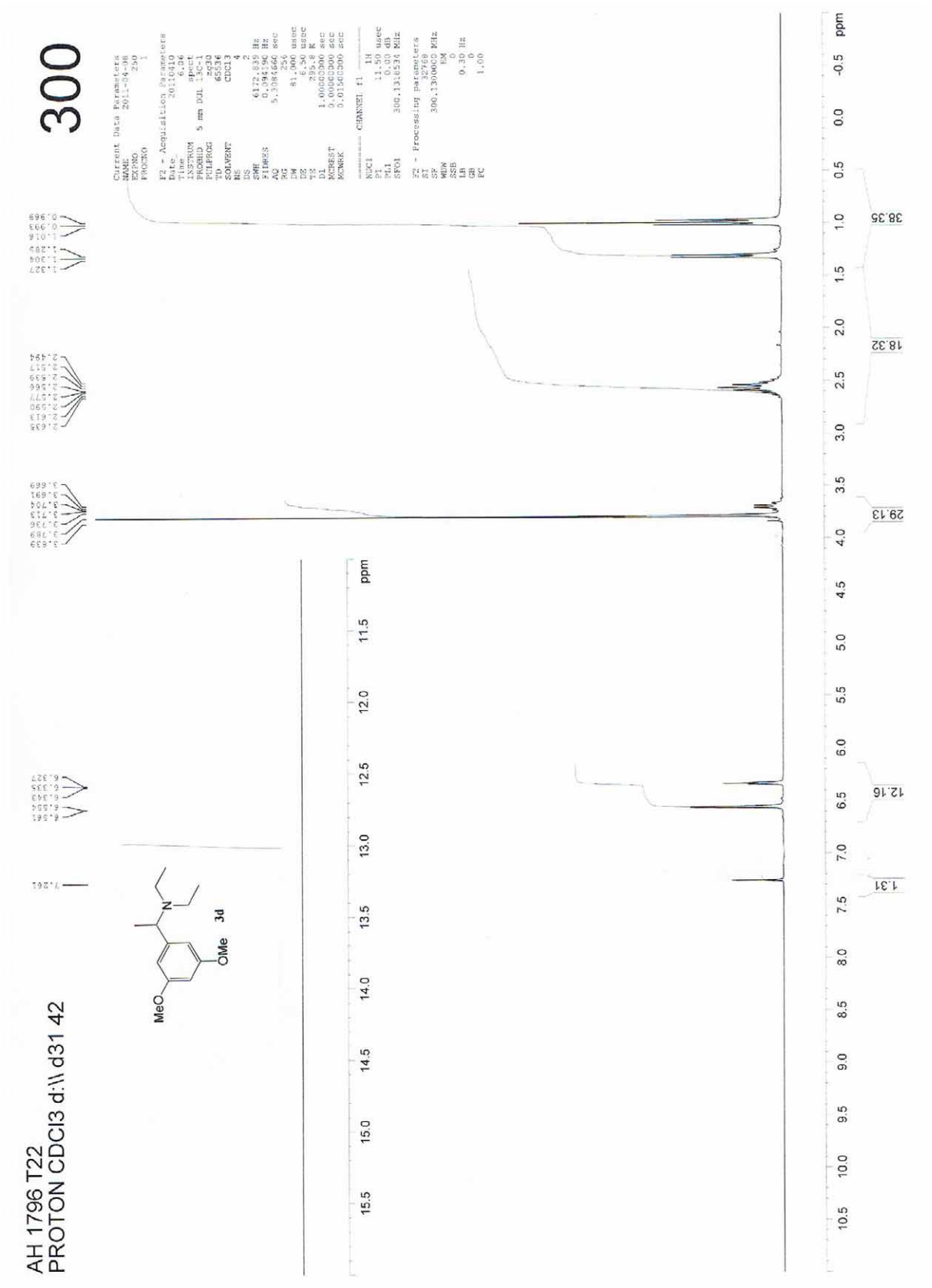
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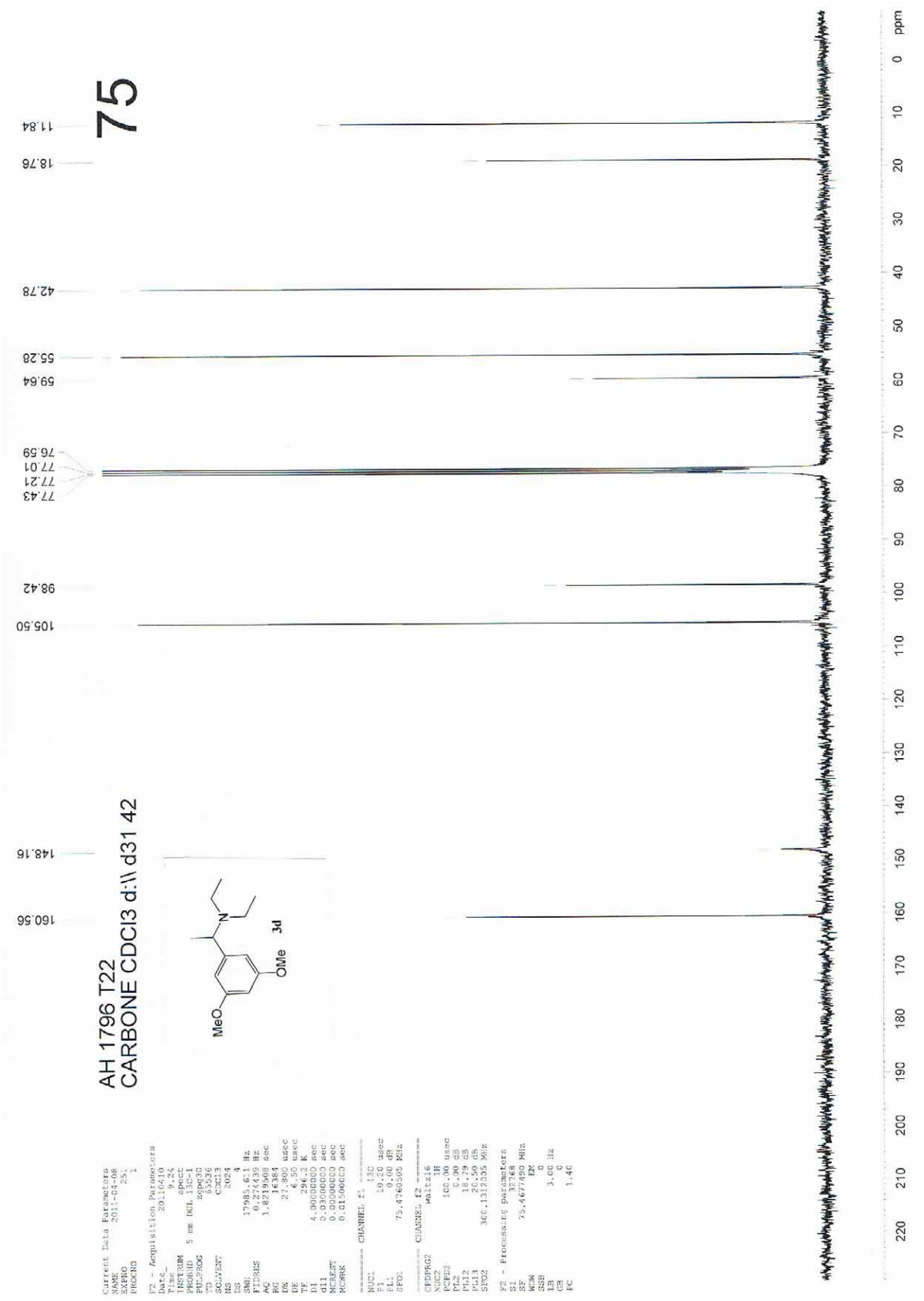
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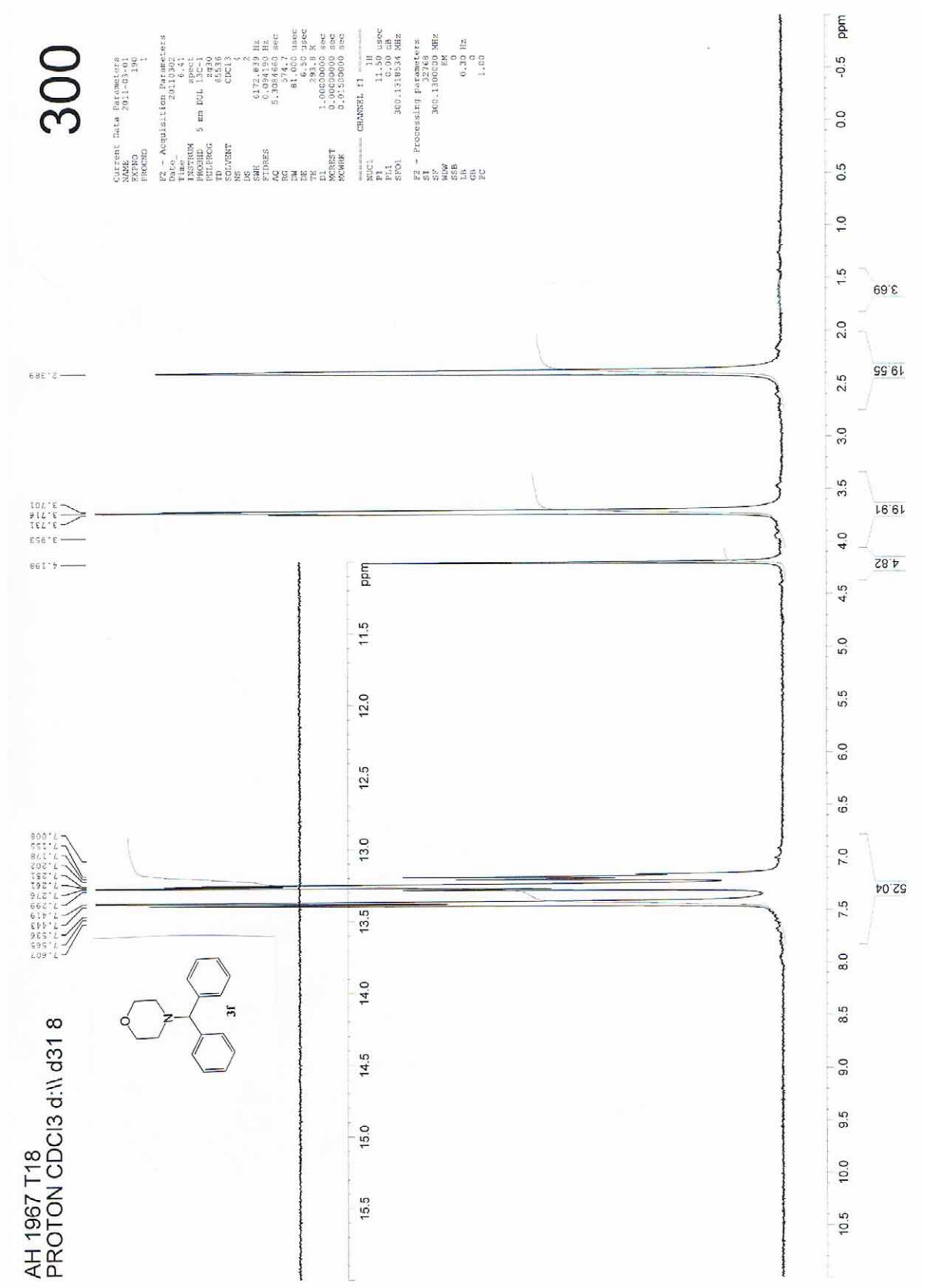
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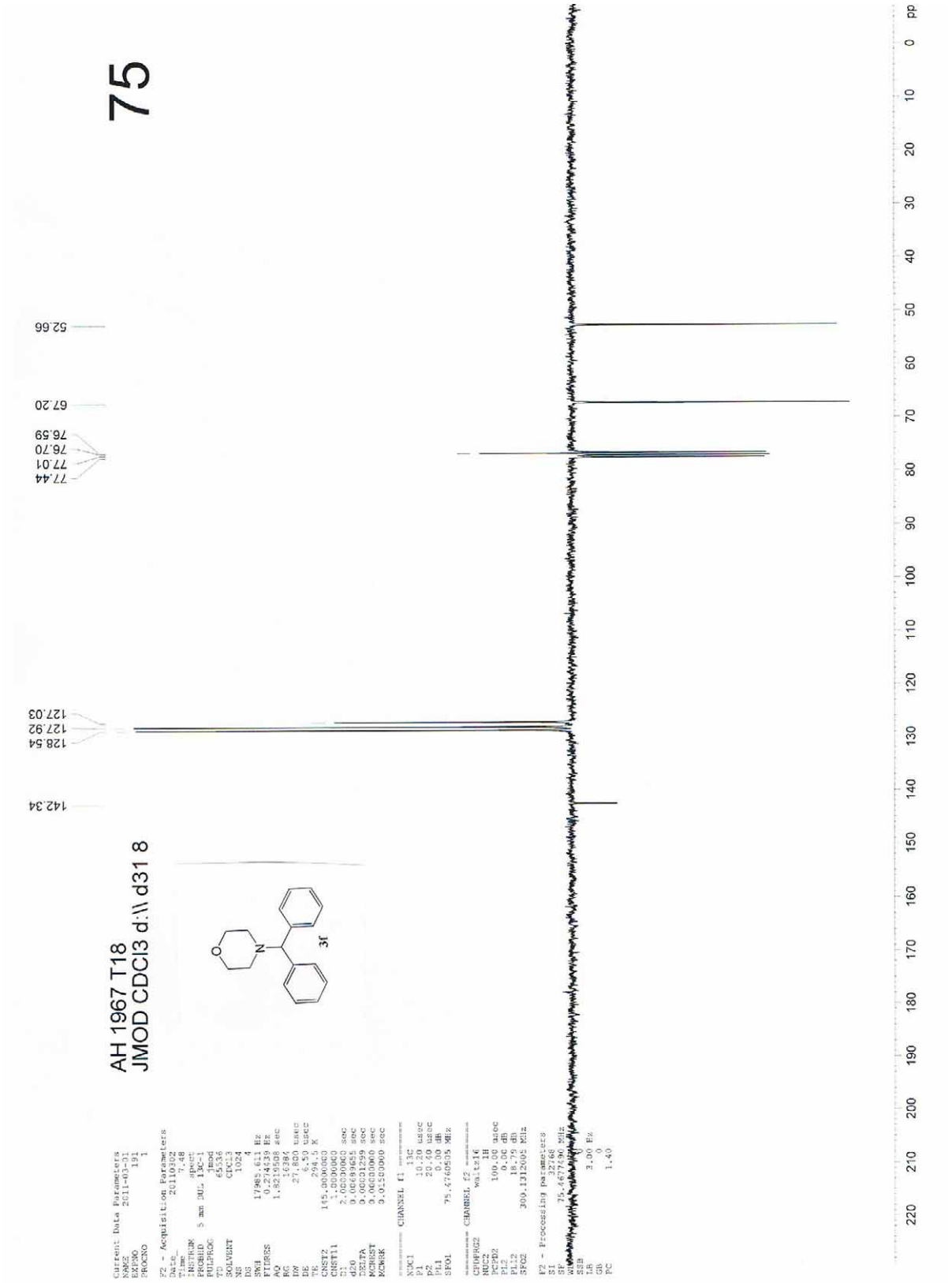
75
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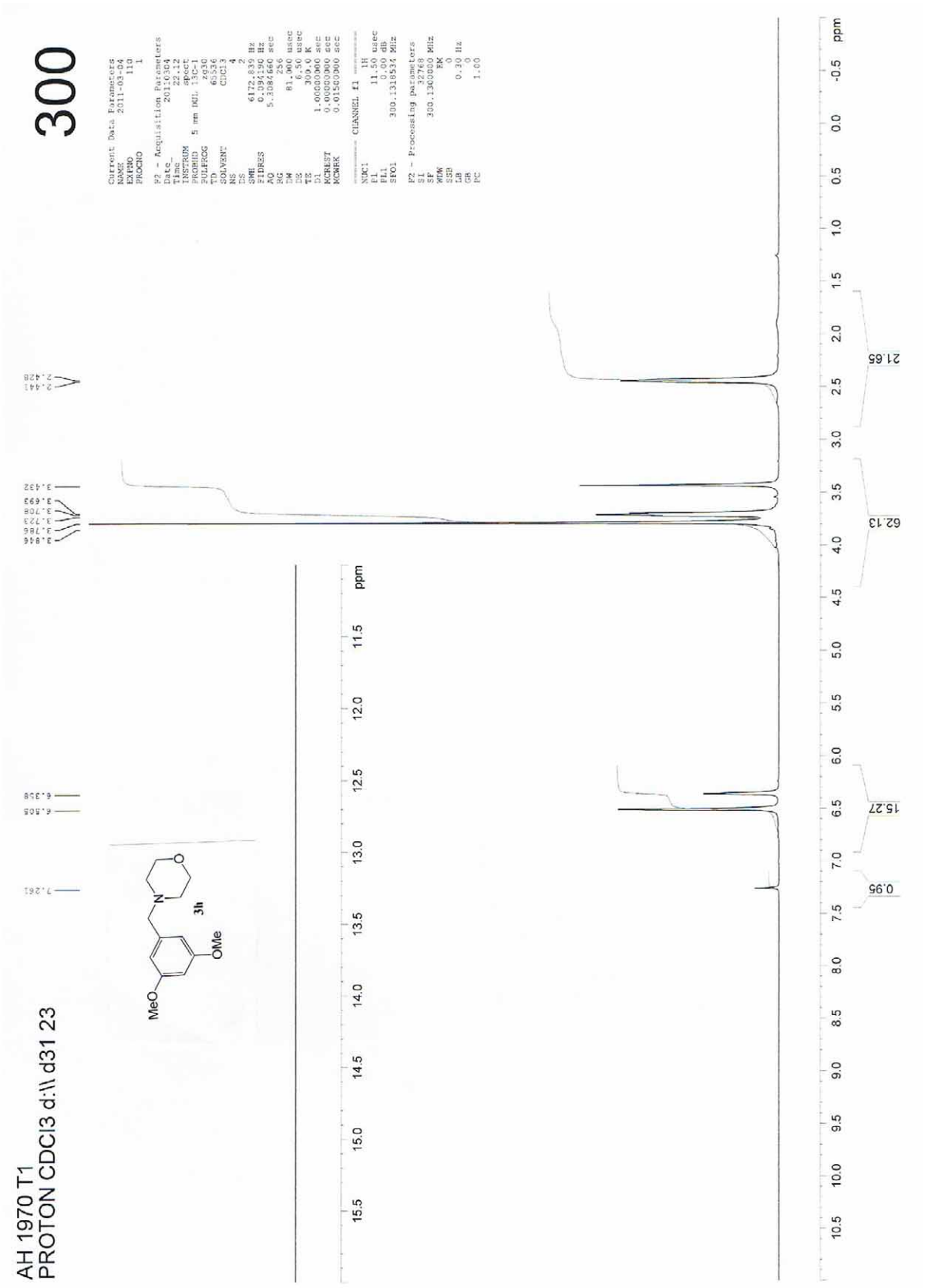
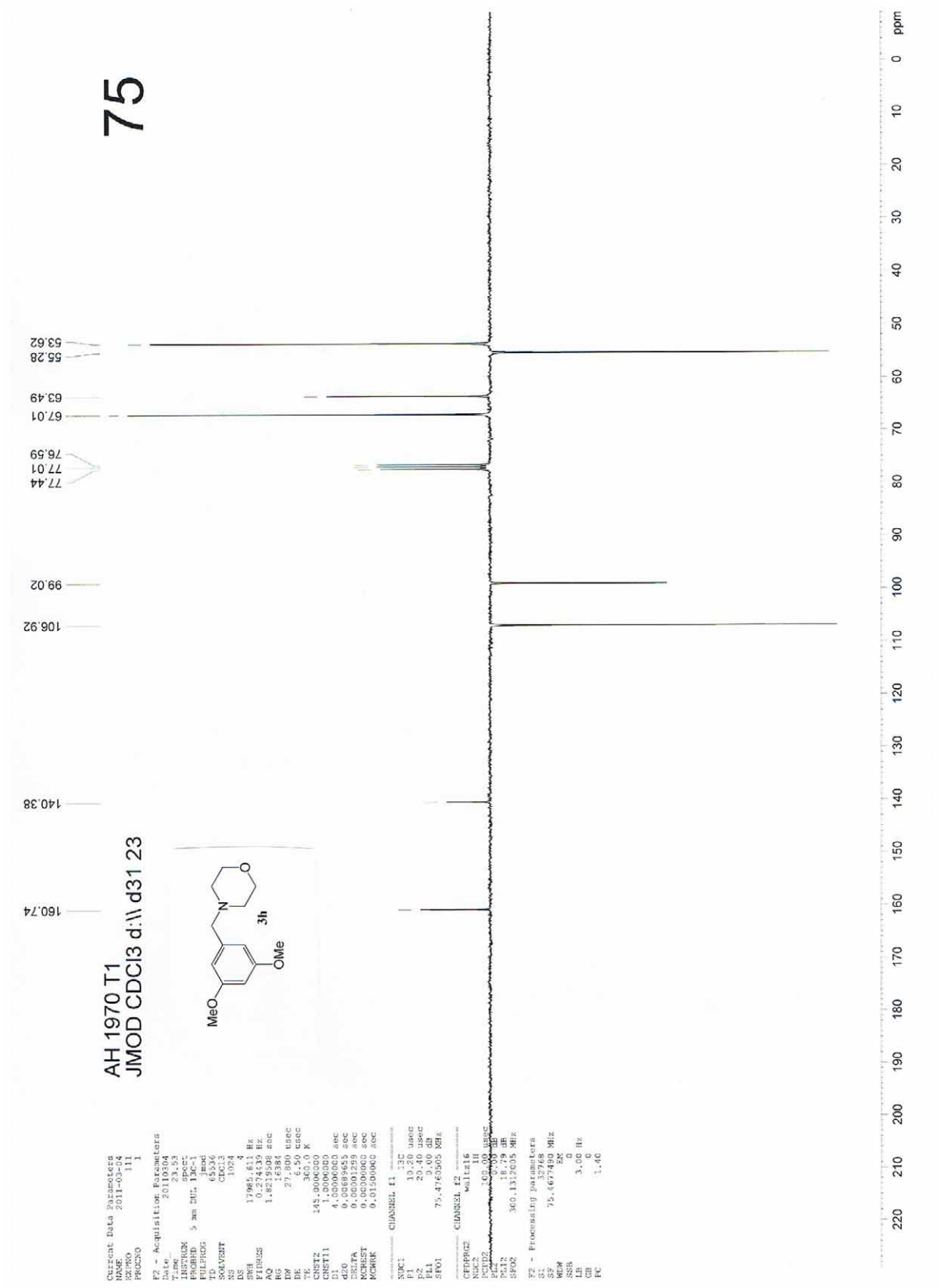
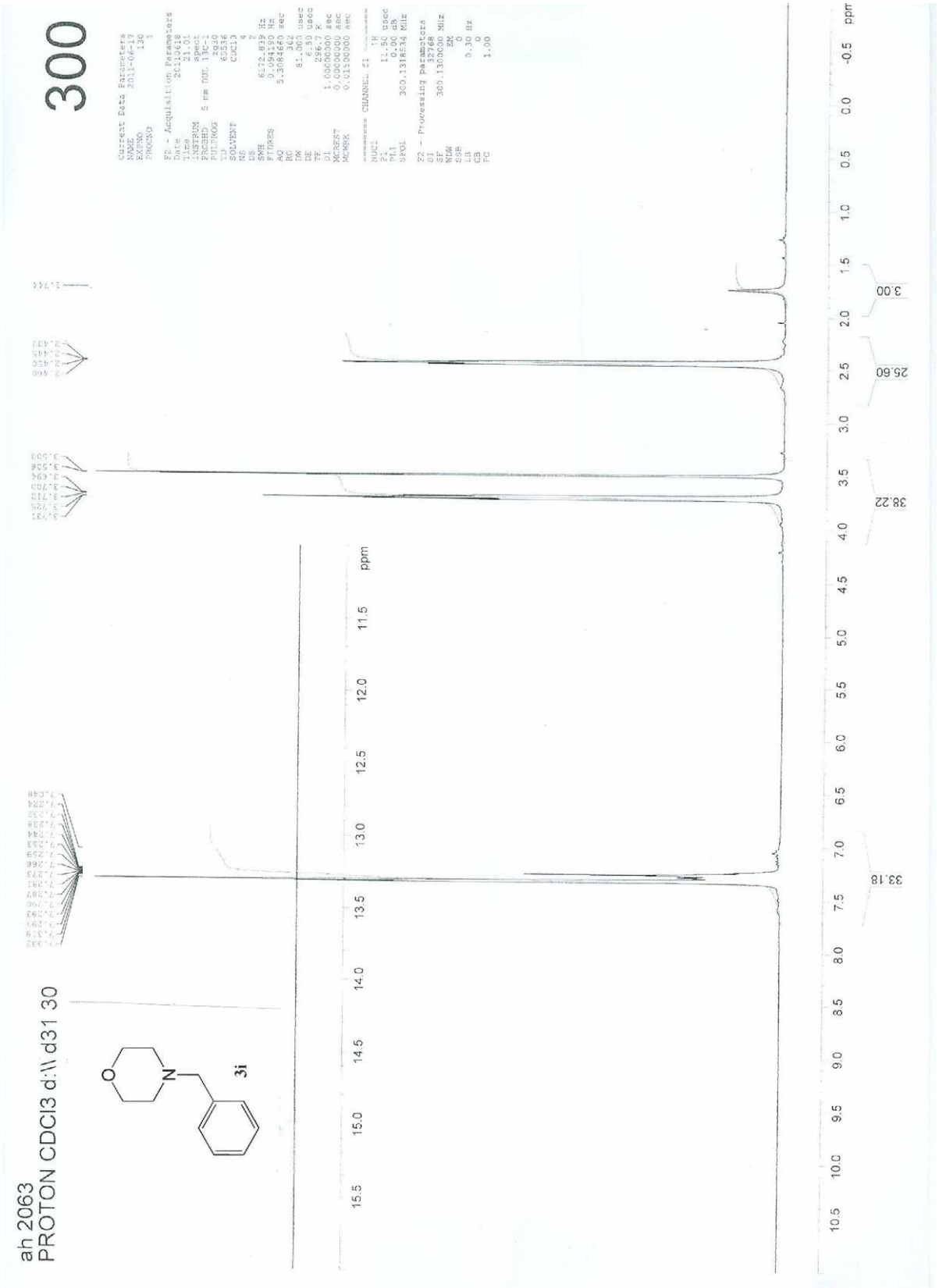
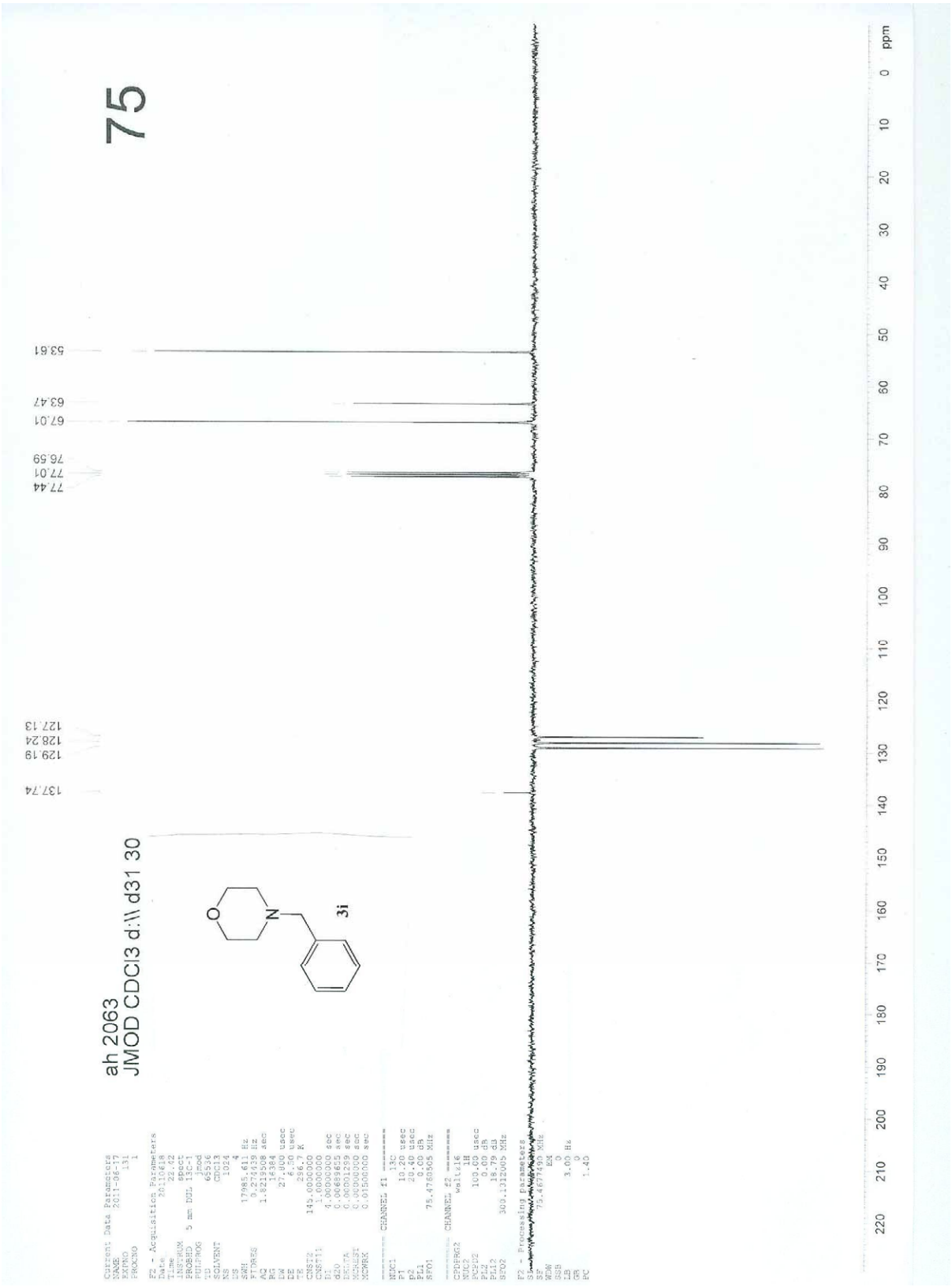
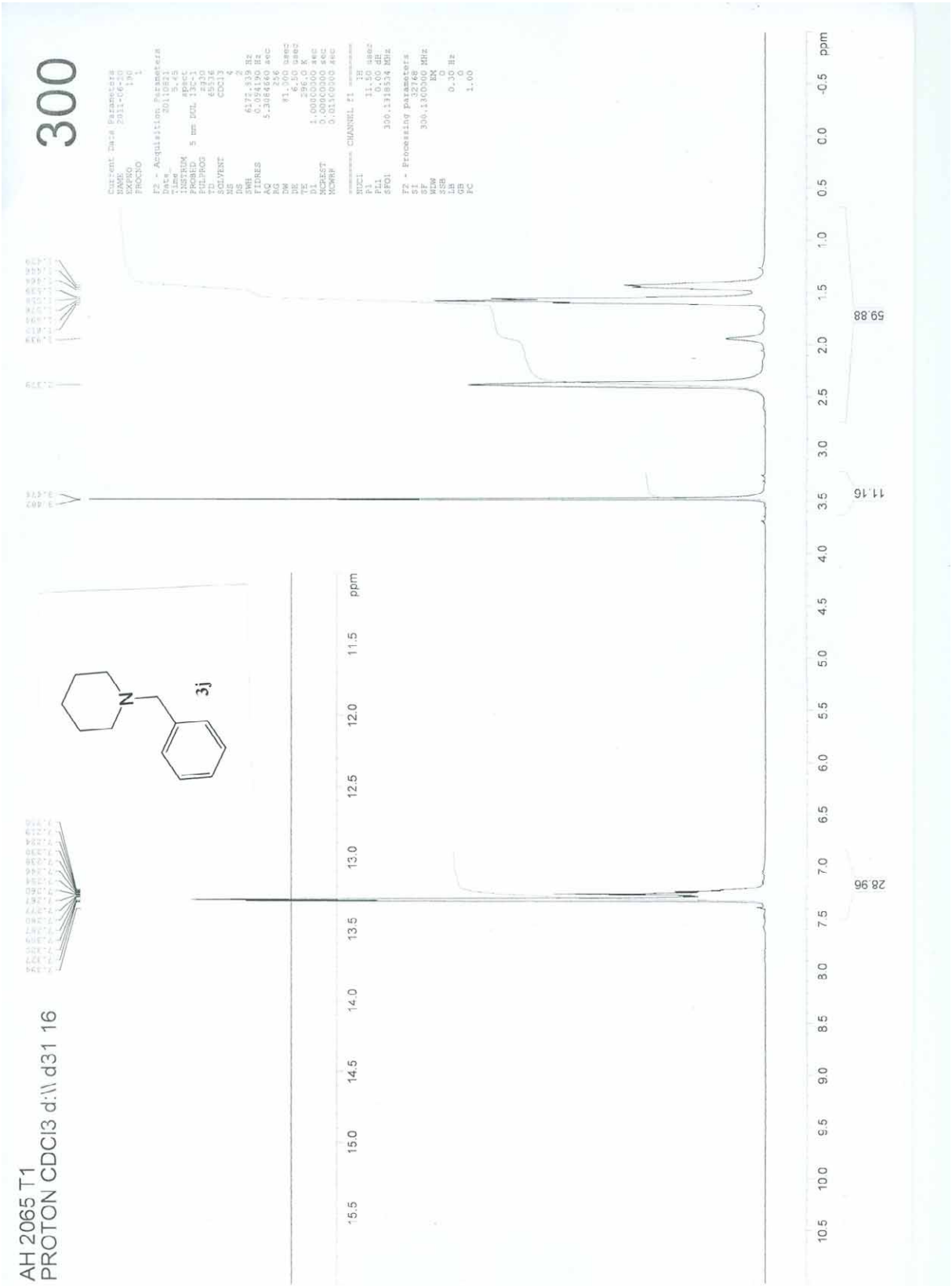
ppm

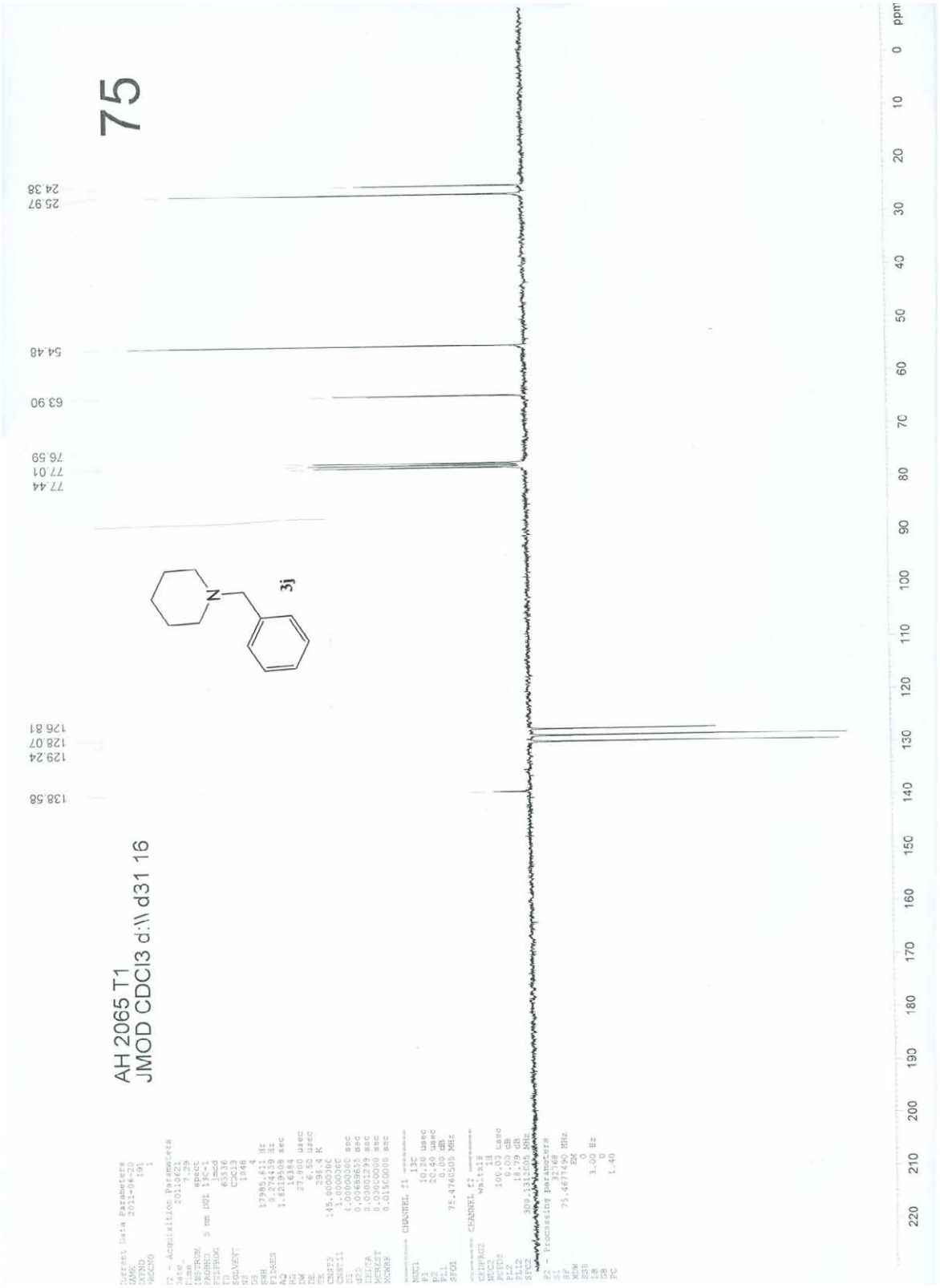


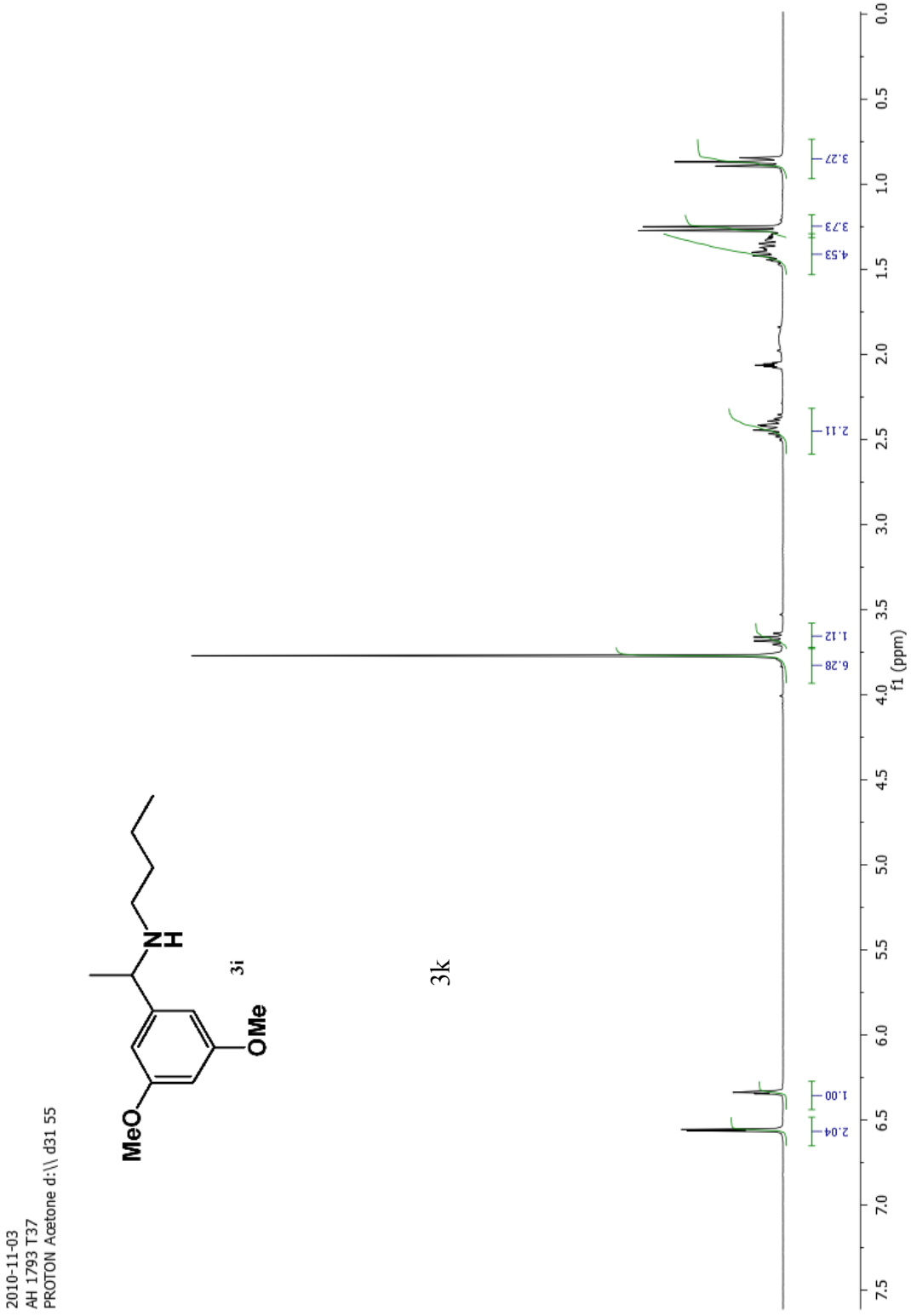

75
AH 1970 T1
JMOD CDCl3 d:\\ d31 23
3h
MeO
OMe
160.74
140.38
106.92
99.02
77.44
77.01
76.59
67.01
63.49
55.28
53.62
ppm

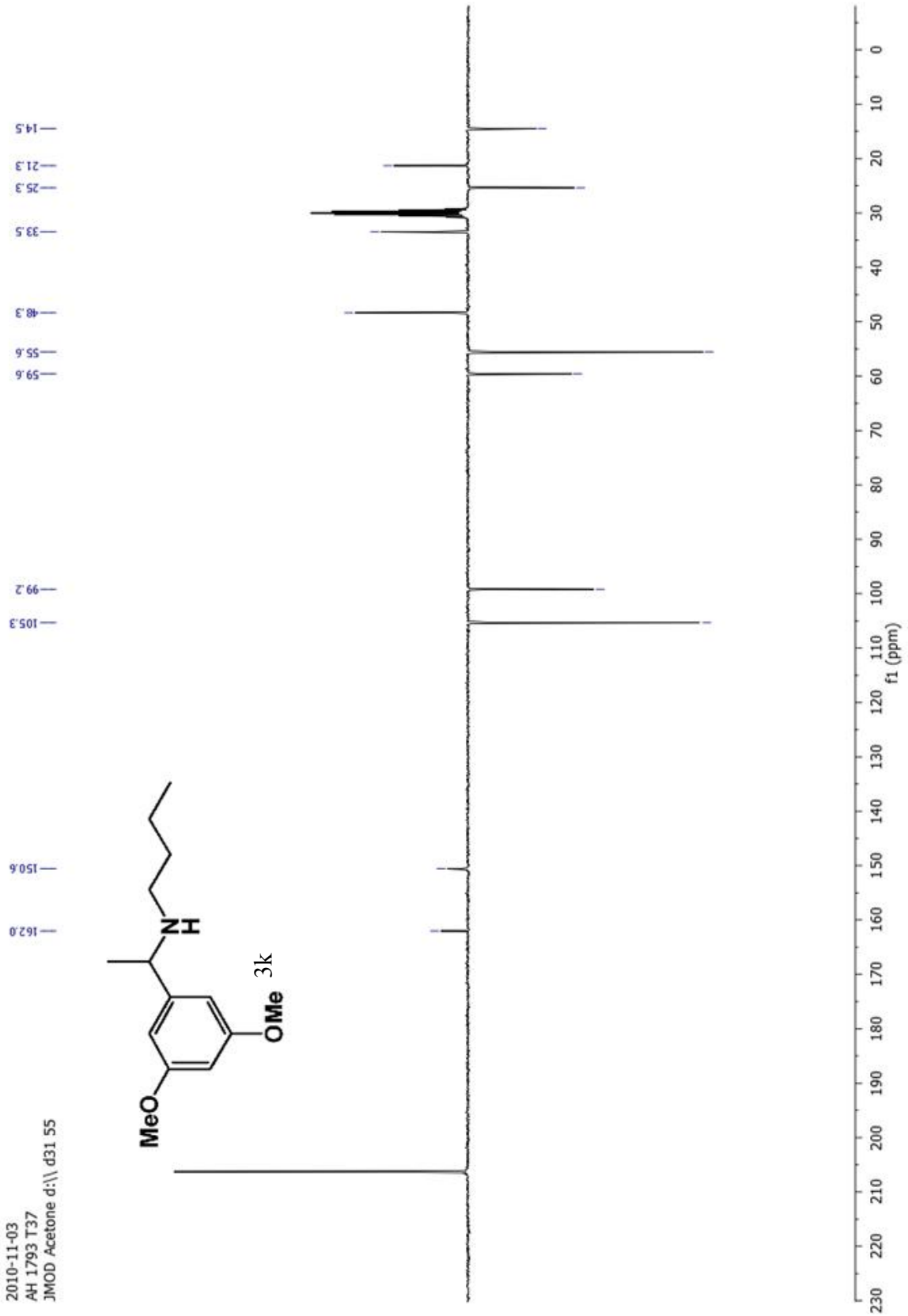

300
ah 2063
PROTON CDCl3 d:\\ d31 30
3i
3.00
25.60
38.22
33.18
ppm

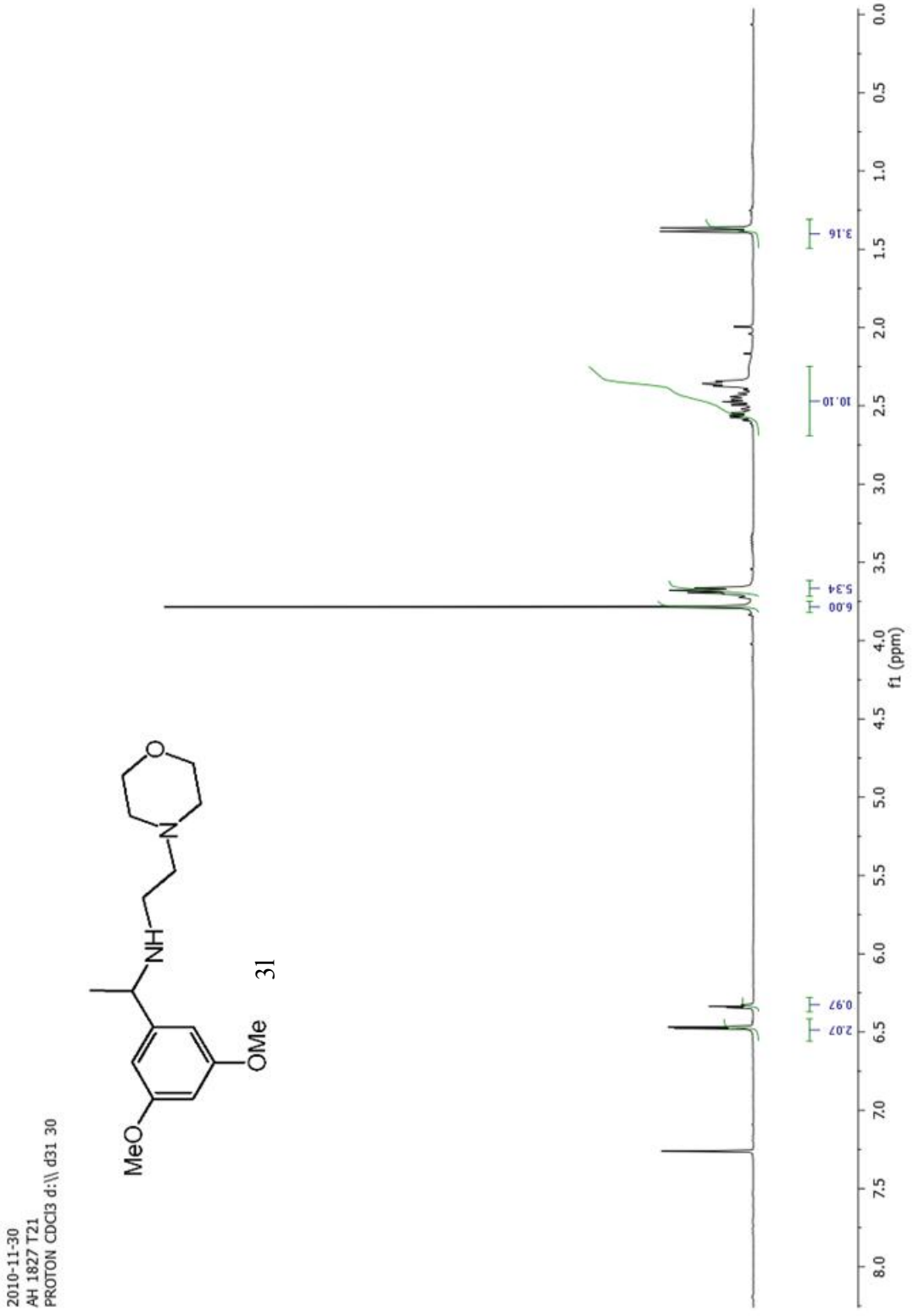

75
ah 2063
JMOD CDCl3 d:\\ d31 30
3i
O
N
53.61
63.47
67.01
76.59
77.01
77.44
127.13
128.24
129.19
137.74
ppm

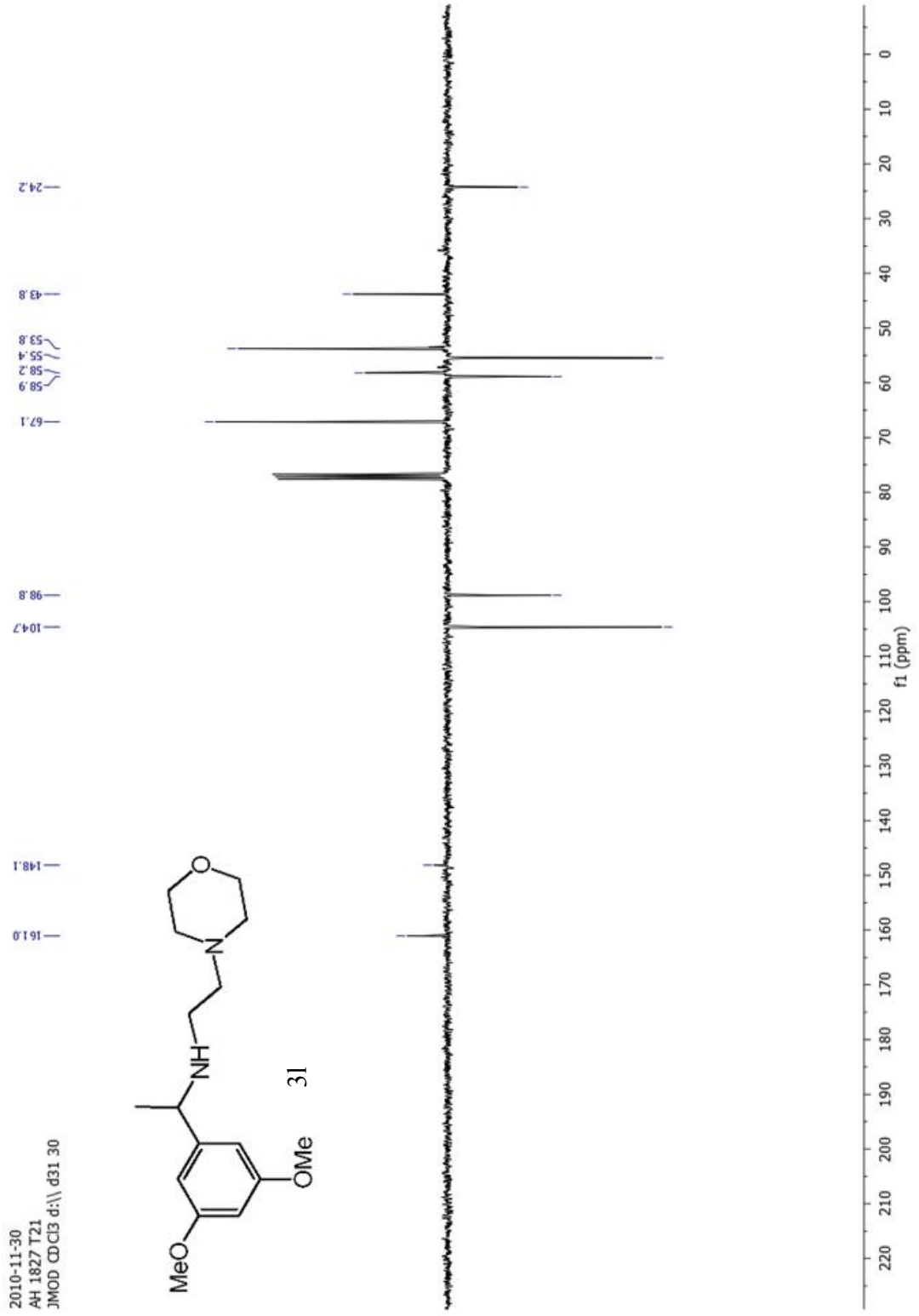

AH 2065 T1
PROTON CDCl3 d:\\ d31 16
300
3j
59.88
11.16
28.96
ppm

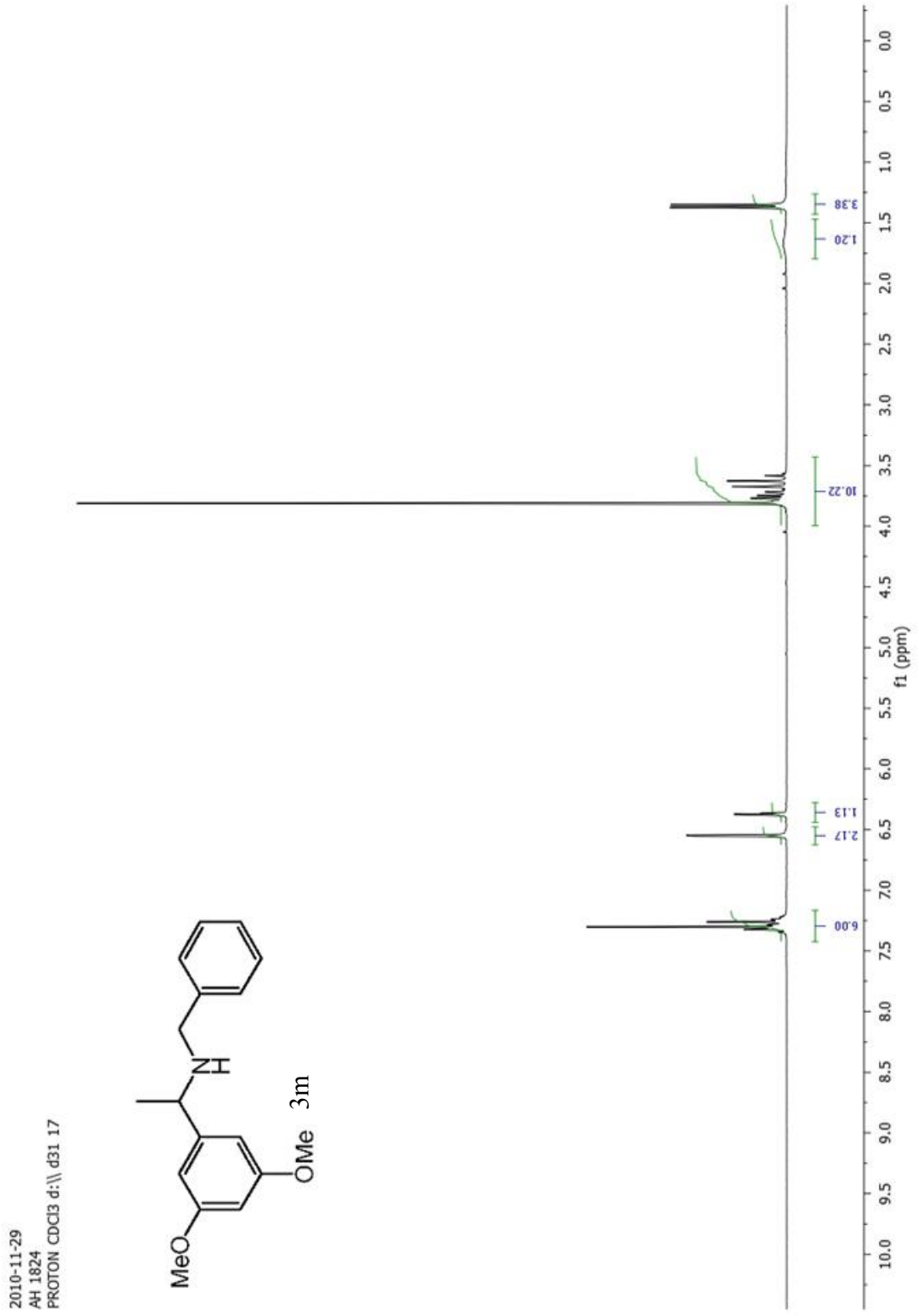

75
AH 2065 T1
JMOD CDCl3 d:\\ d31 16
3j
N
24.38
25.97
54.48
63.90
76.59
77.01
77.44
126.81
128.07
129.24
138.58
ppm

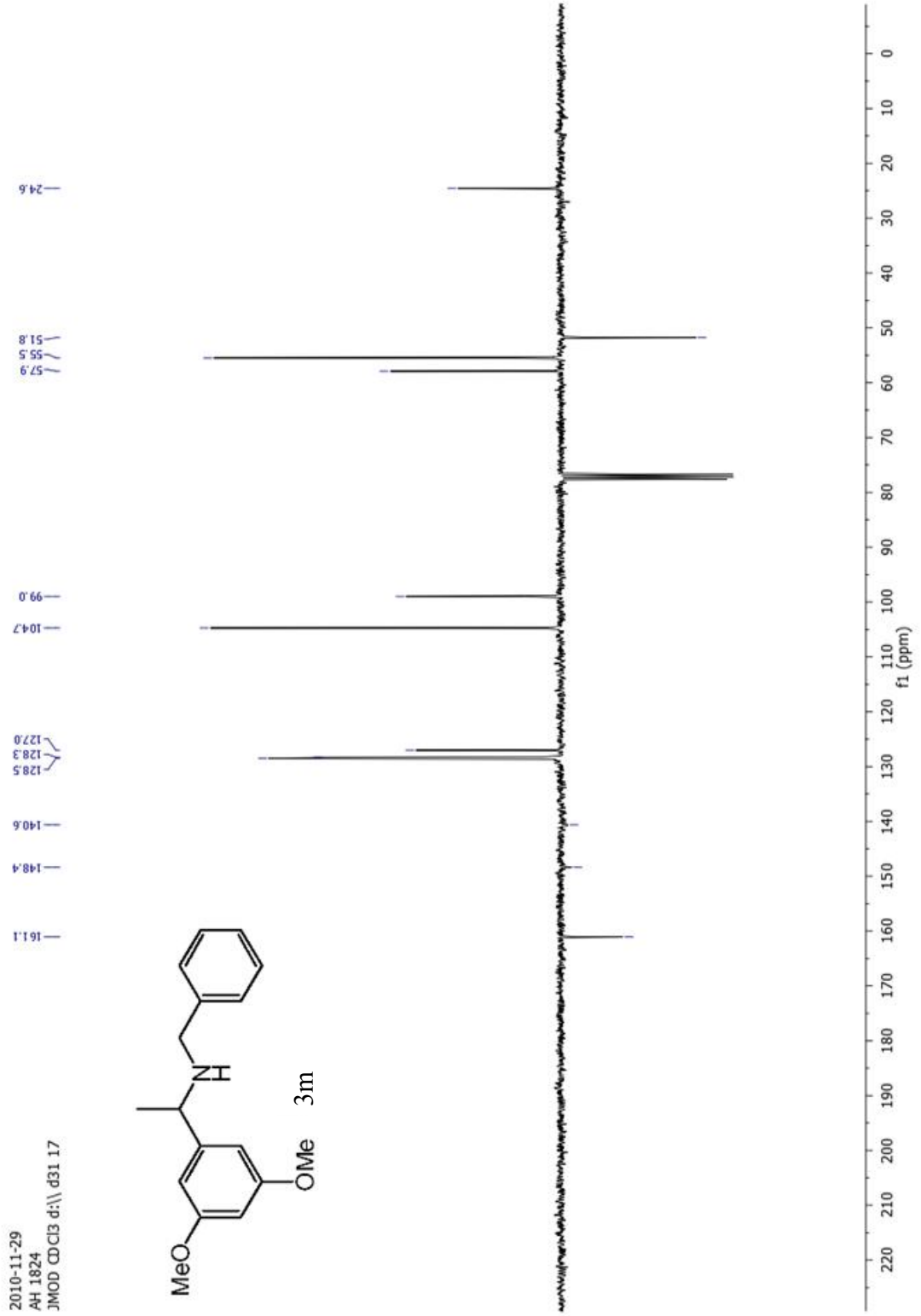


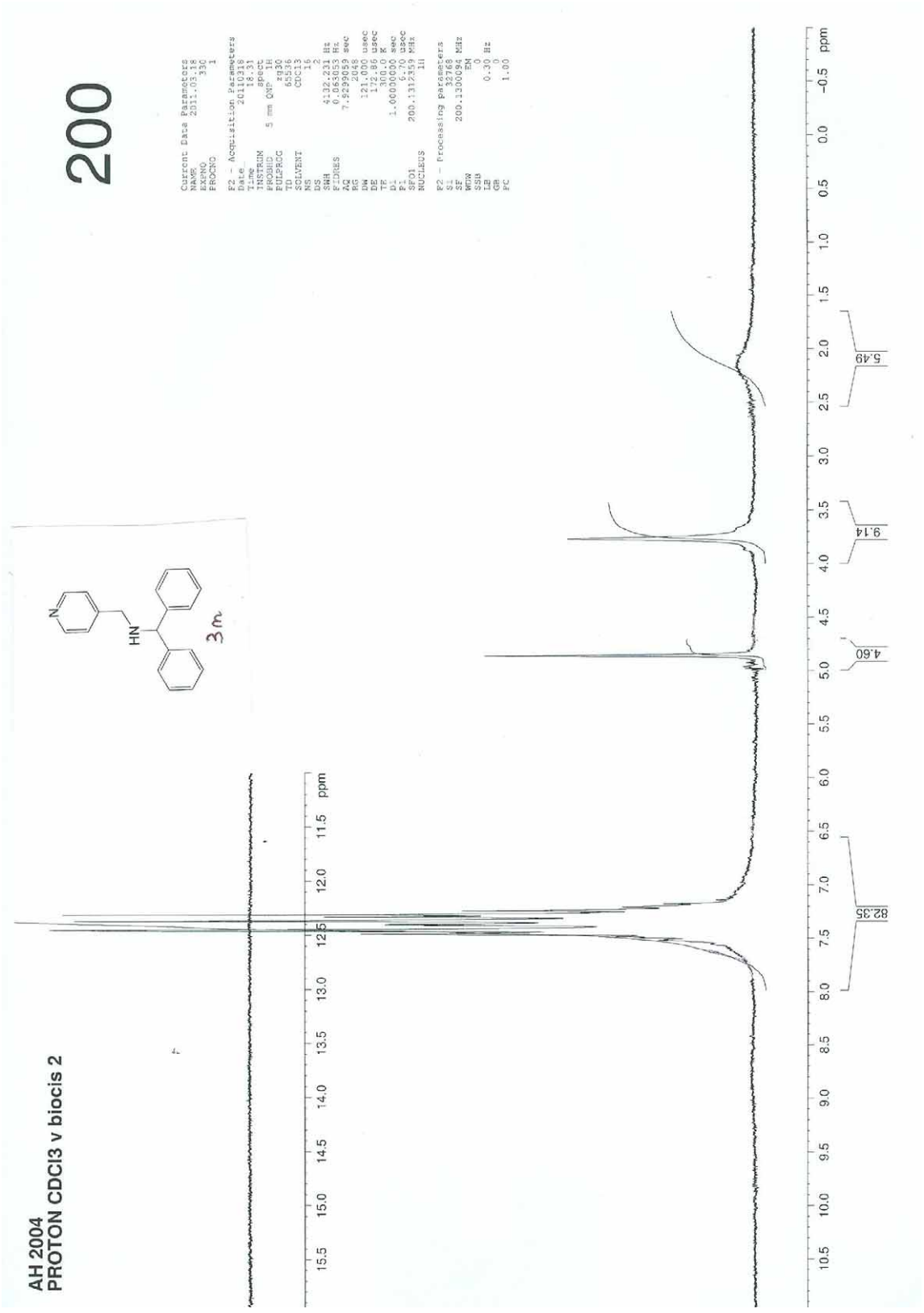


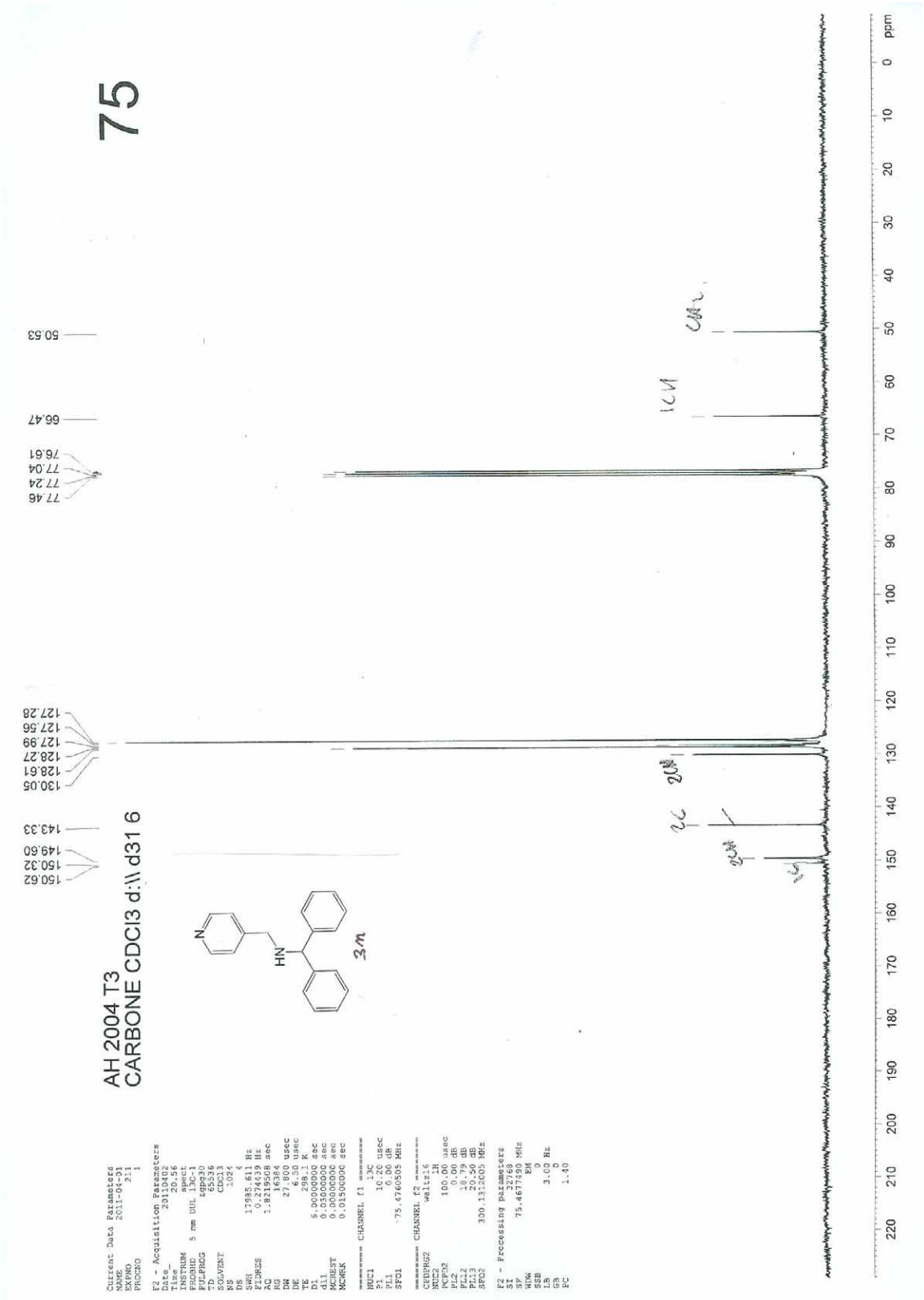

2010-11-30
AH 1827 T21
PROTON CDCl3 d:\\ d31 30
MeO
NH
N
O
OMe
31
3.16
10.10
6.00
5.34
0.97
2.07
f1 (ppm)

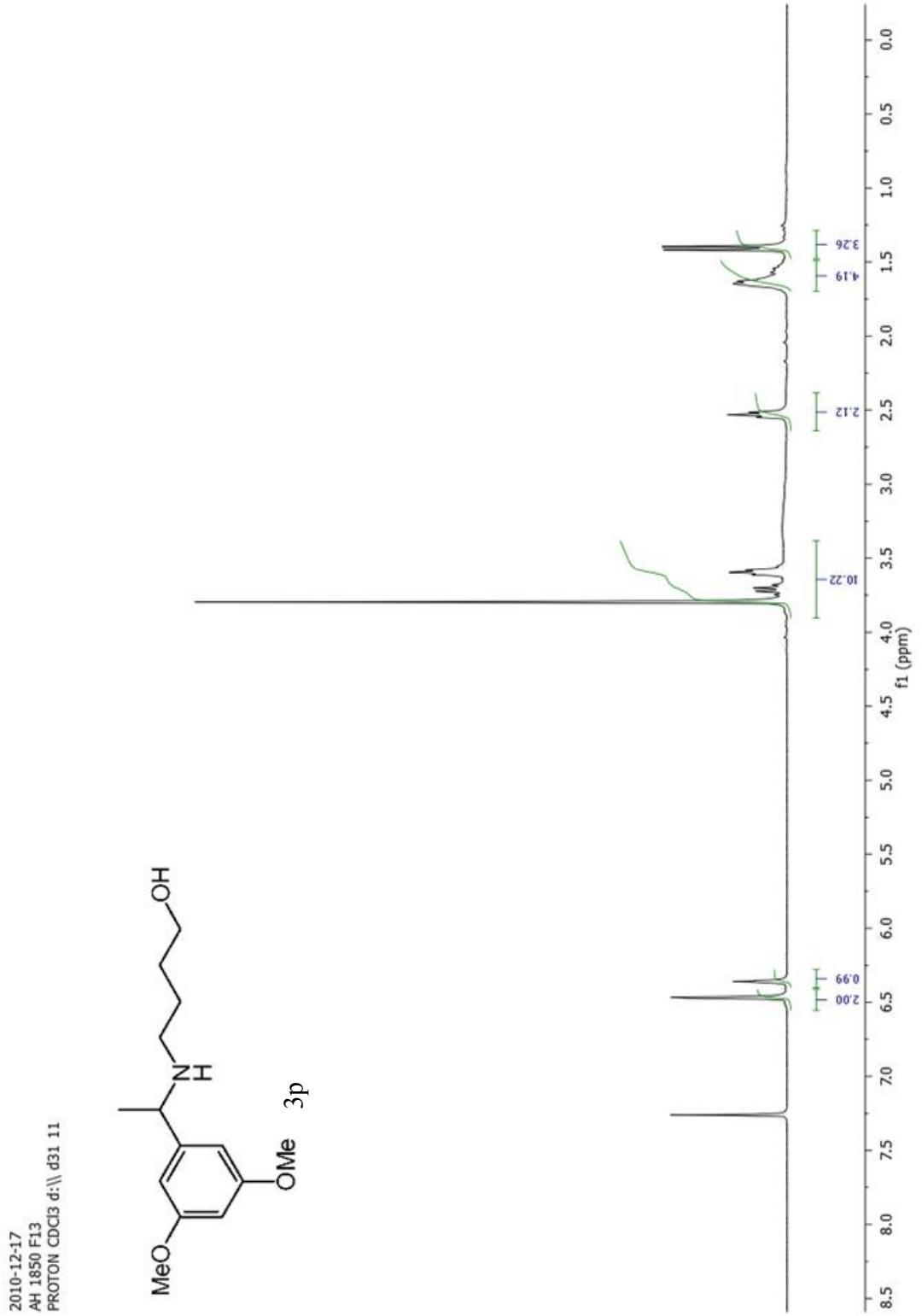


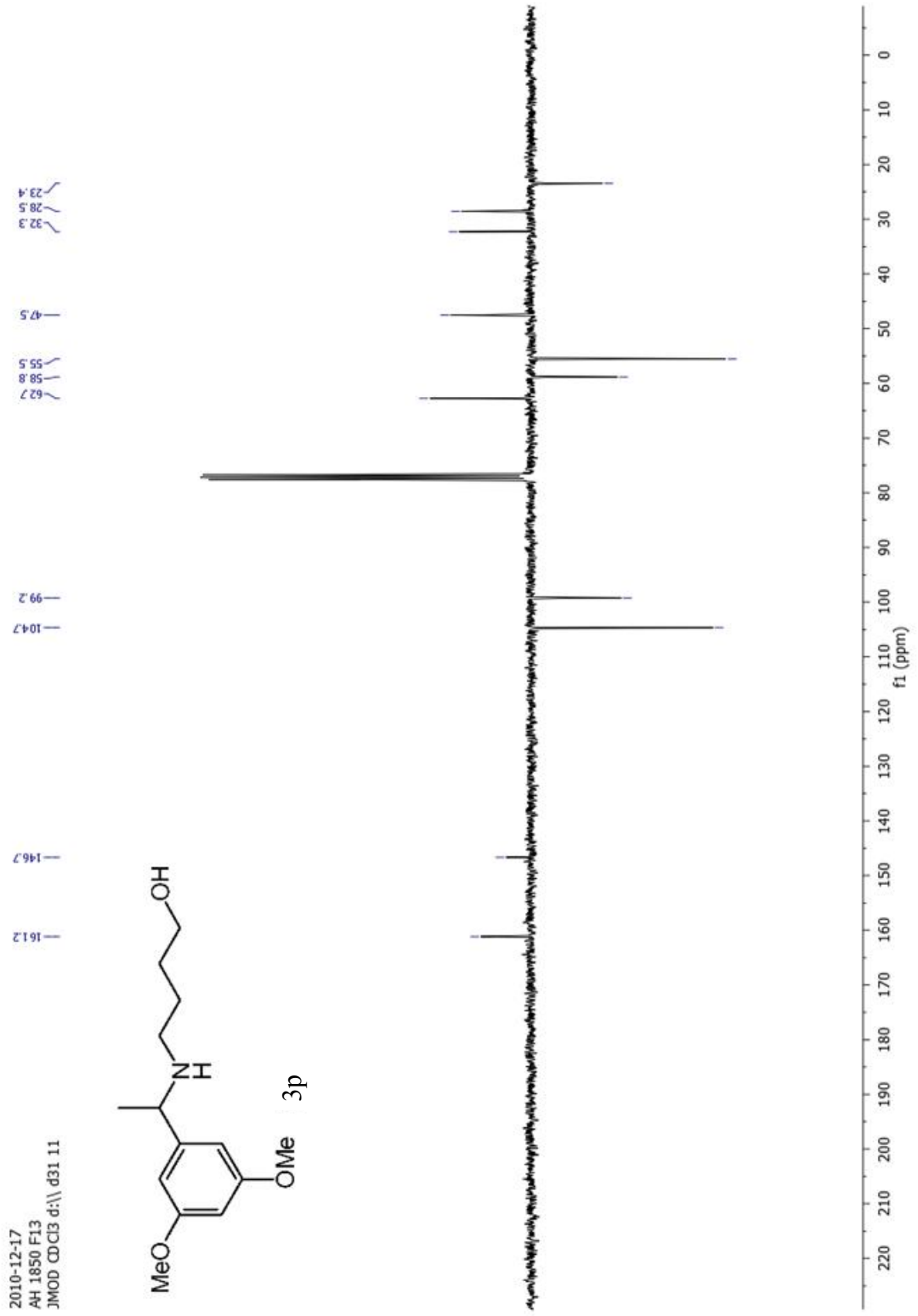

2010-11-29
AH 1824
PROTON CDCl3 d:\\ d31 17
MeO
OMe
3m
NH
3.38
1.20
10.22
1.13
2.17
6.00
f1 (ppm)

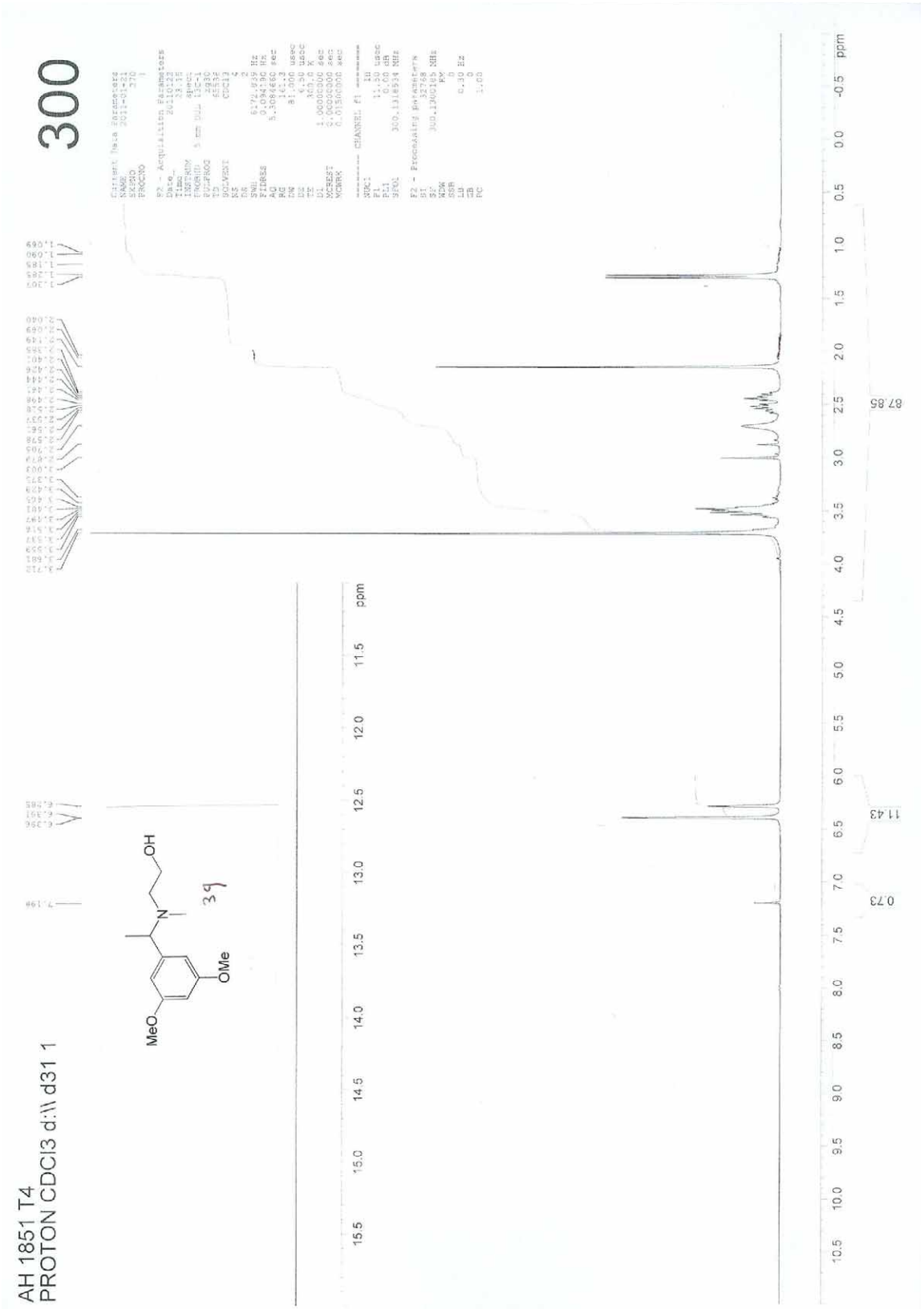


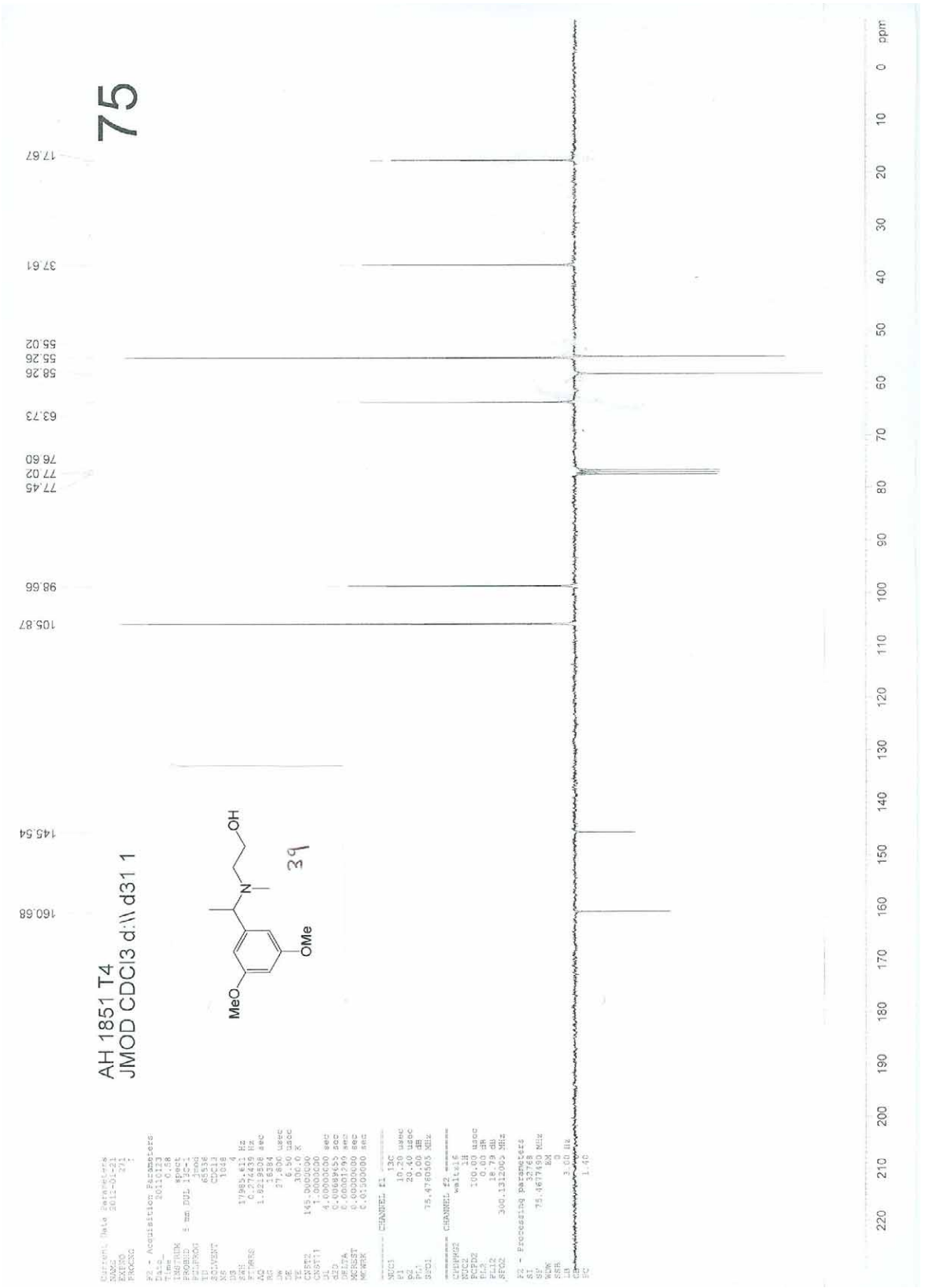

AH 2004
PROTON CDCl3 v biocis 2
200
3m
HN
N
5.49
9.14
4.60
82.35
ppm

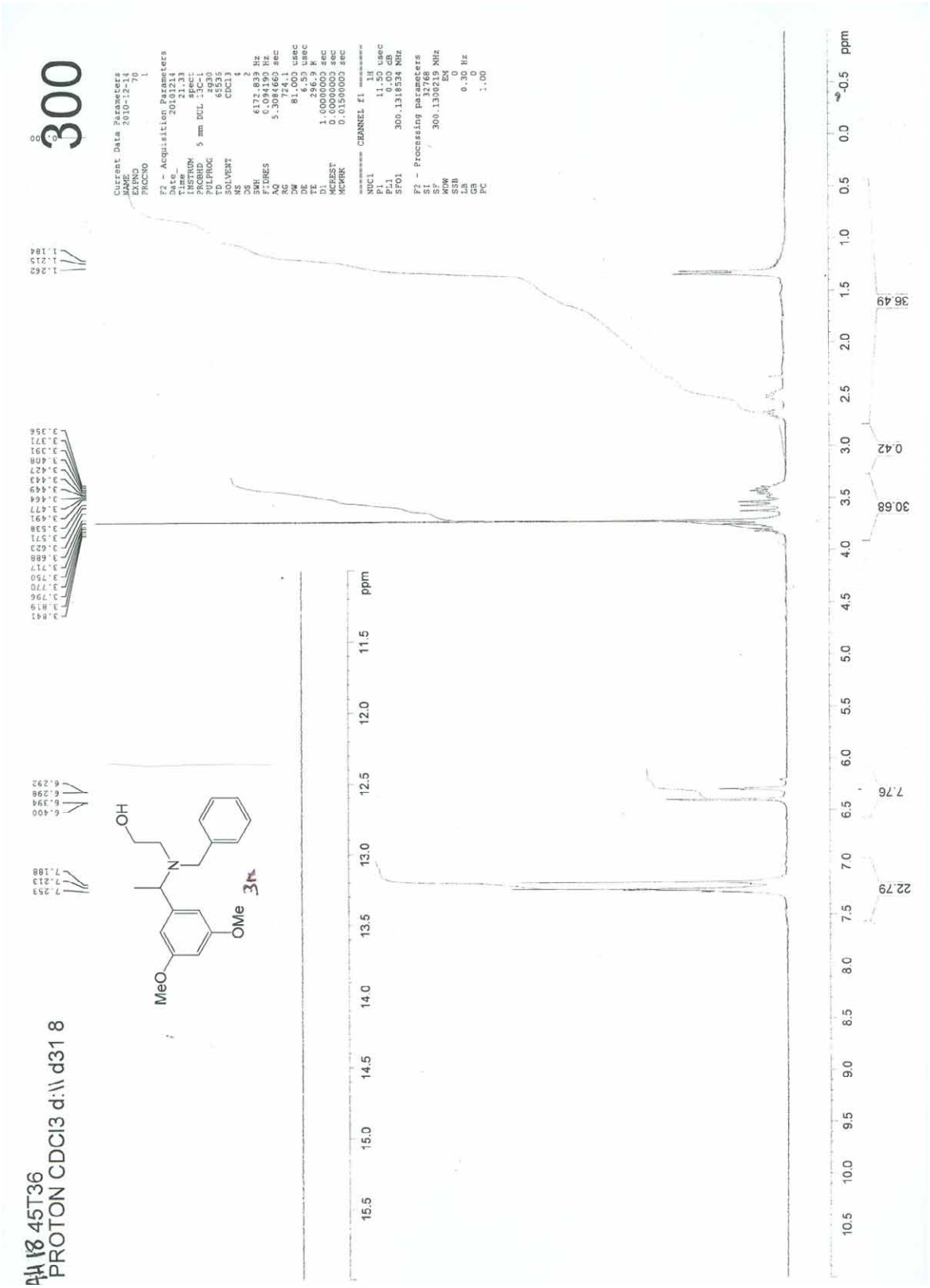

75
AH 2004 T3
CARBONE CDCl3 d:\\ d31 6
3m
HN
N
150.62
150.32
149.60
143.33
130.05
128.61
128.27
127.99
127.56
127.28
77.46
77.24
77.04
76.61
66.47
50.53
ppm

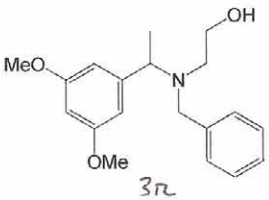


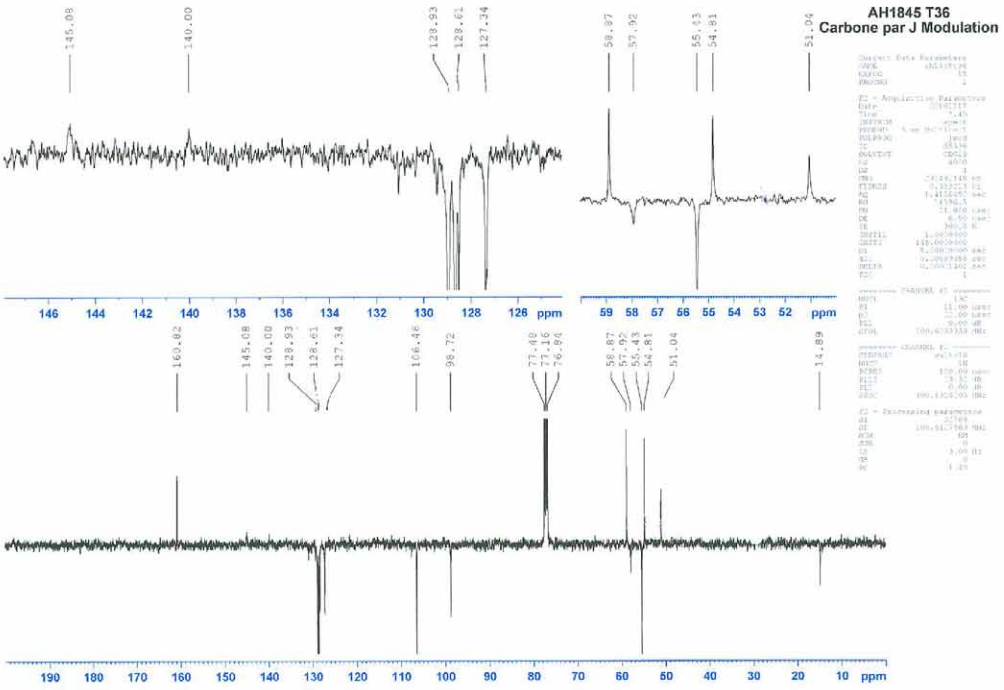

2010-12-17
AH 1850 F13
JMOD CDCl3 d:\\ d31 11
MeO
OMe
OH
N
H
3p
146.7
161.2
99.2
104.7
47.5
62.7
58.8
55.5
32.3
28.5
23.4
f1 (ppm)

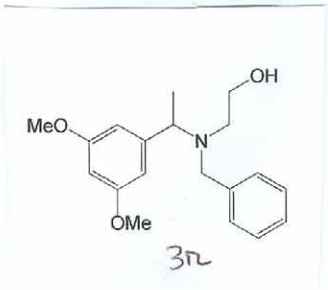

AH 1851 T4
PROTON CDCl3 d:\\ d31 1
300
OH
N
MeO
OMe
87.85
11.43
0.73
ppm

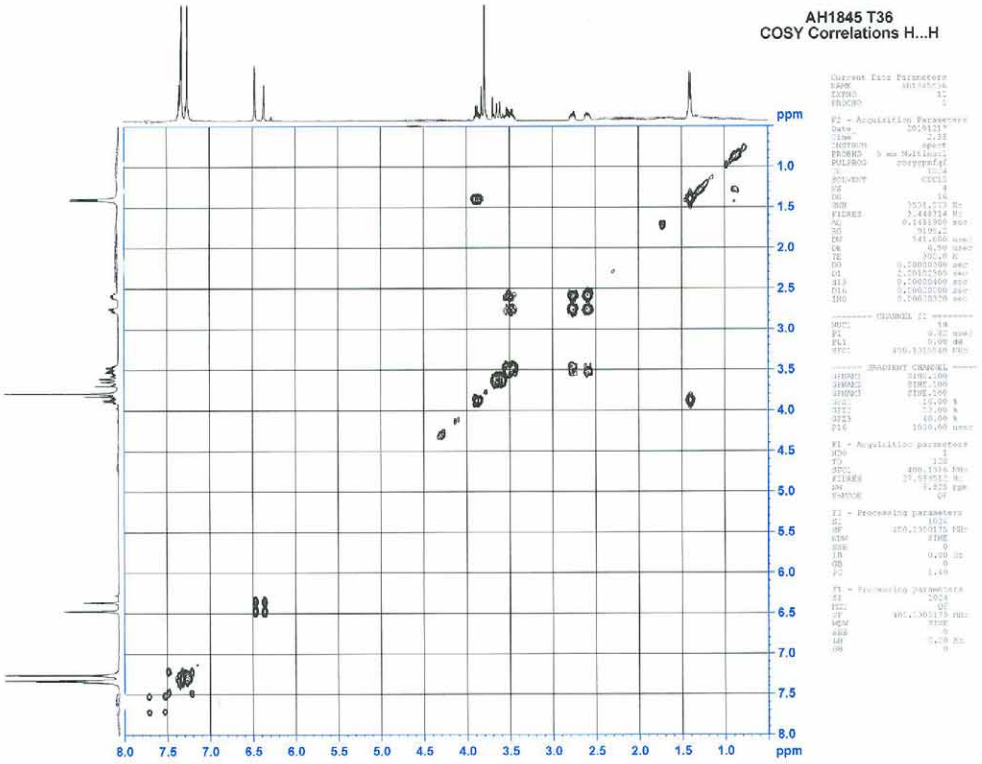

75
AH 1851 T4
JMOD CDCl3 d:\\ d31 1
OH
N
OMe
MeO
39
17.67
37.61
55.02
55.26
58.26
63.73
76.60
77.02
77.45
98.66
105.87
145.54
160.68
ppm

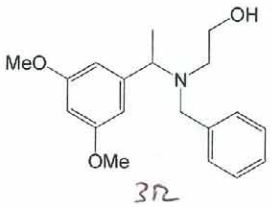

AH 18 45T36
PROTON CDCl3 d:\\ d31 8
300
OH
N
MeO
OMe
3r
ppm
36.49
0.42
30.68
7.76
22.79


OH
MeO
N
OMe
3n

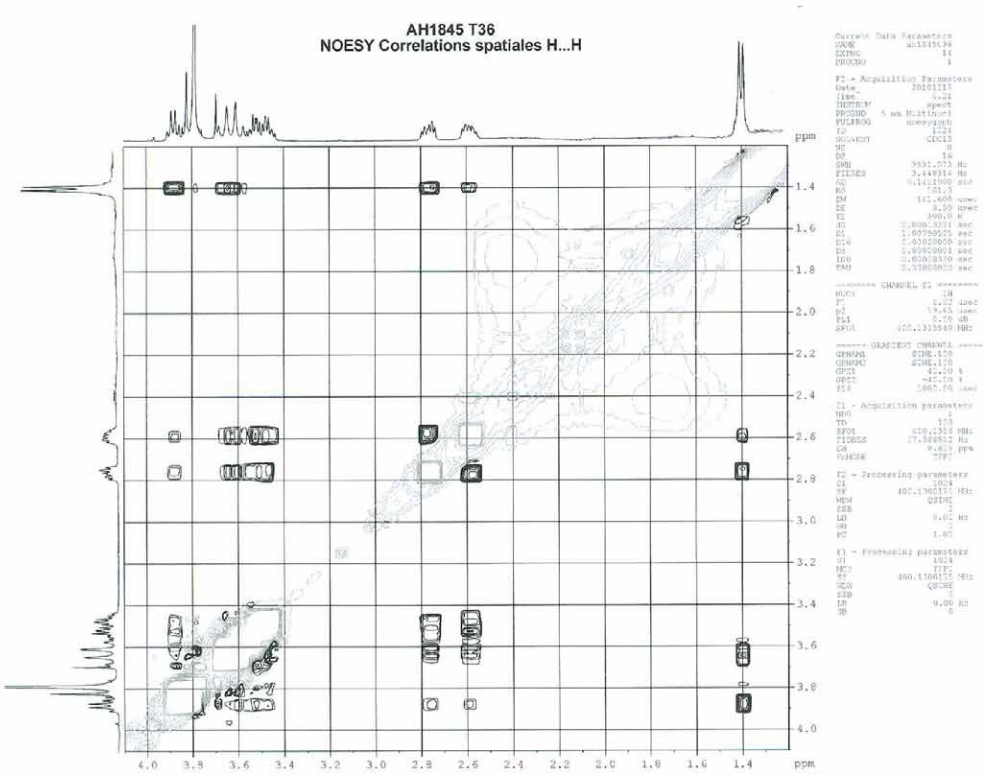

AH1845 T36
Carbone par J Modulation
145.08
140.00
129.93
128.61
127.34
58.87
57.92
55.13
54.81
51.04
146 144 142 140 138 136 134 132 130 128 126 ppm
59 58 57 56 55 54 53 52 ppm
160.02
145.08
140.00
129.93
128.61
127.34
106.46
98.72
77.40
77.16
76.84
58.87
57.92
55.13
54.81
51.04
14.89
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

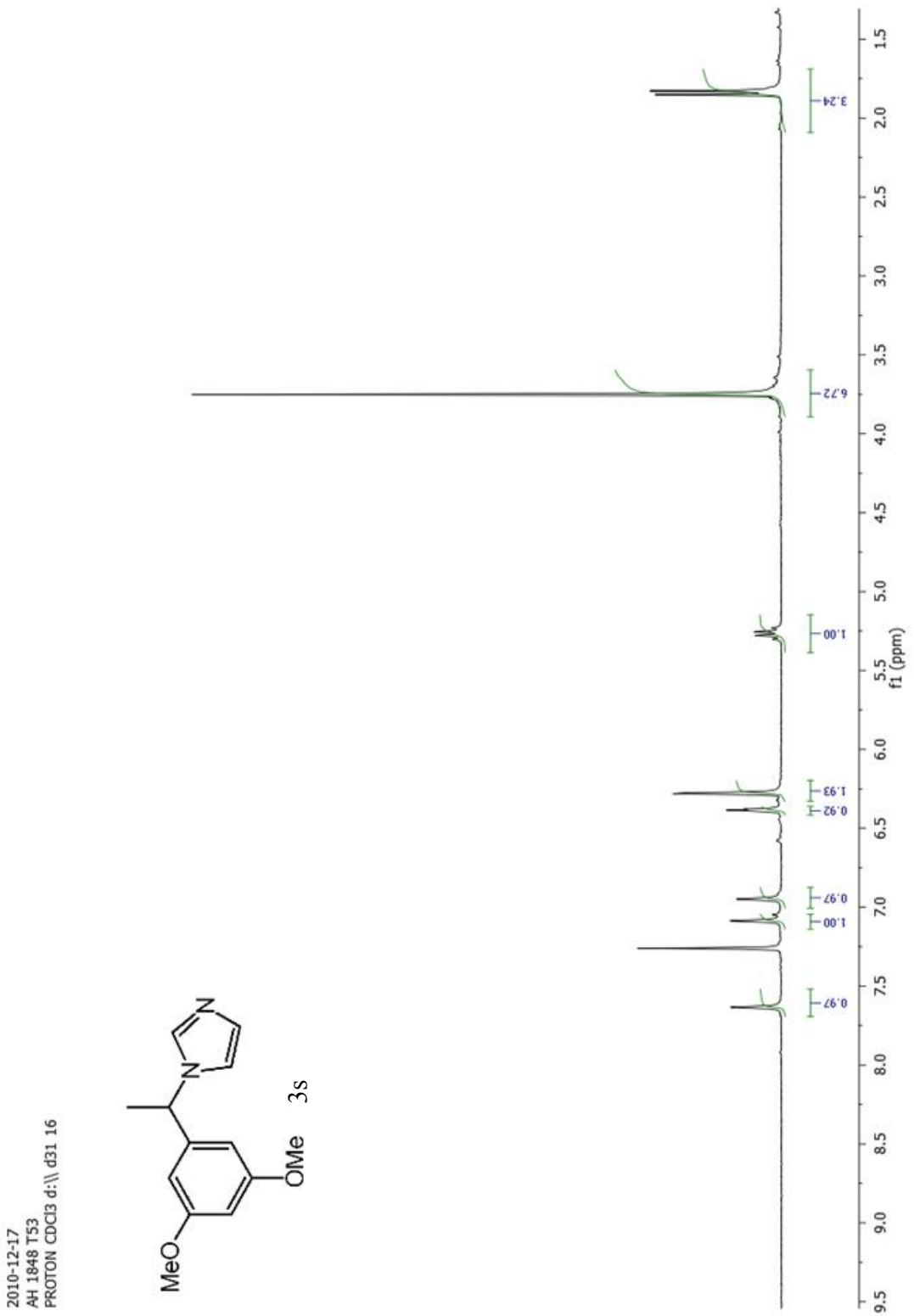

OH
MeO
N
OMe
3Tc

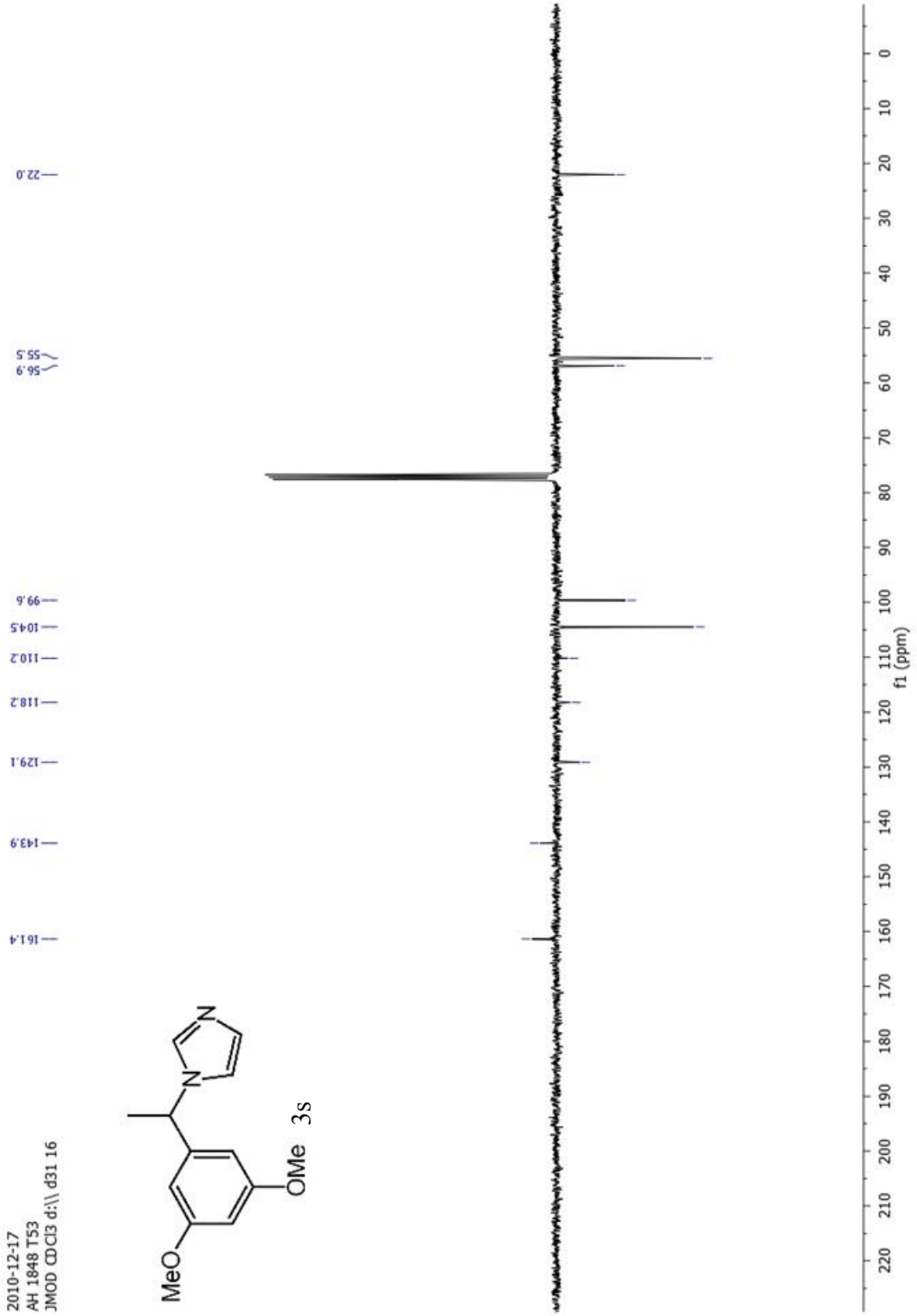

AH1845 T36
COSY Correlations H...H
ppm
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 ppm

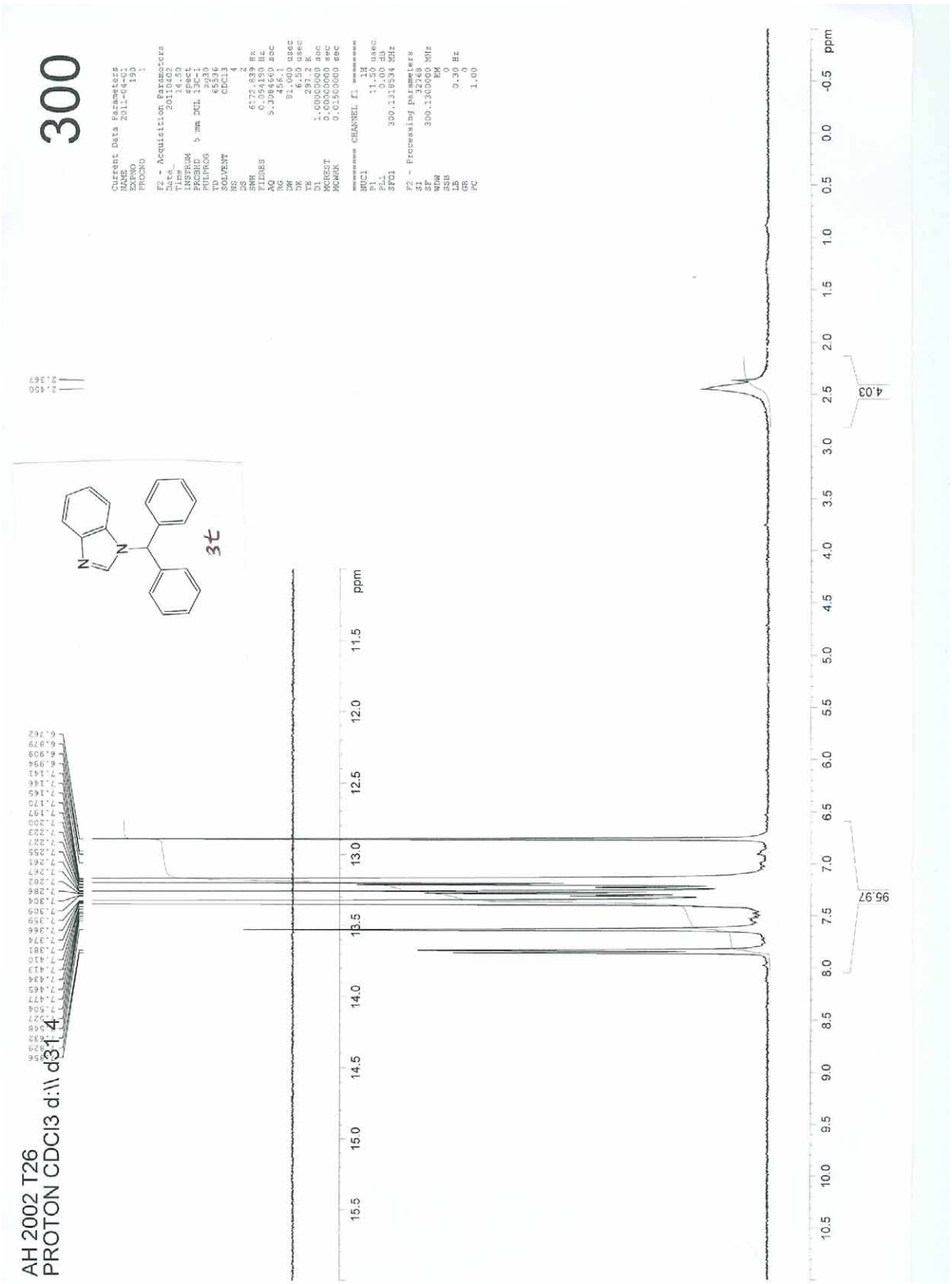

OH
MeO
N
OMe

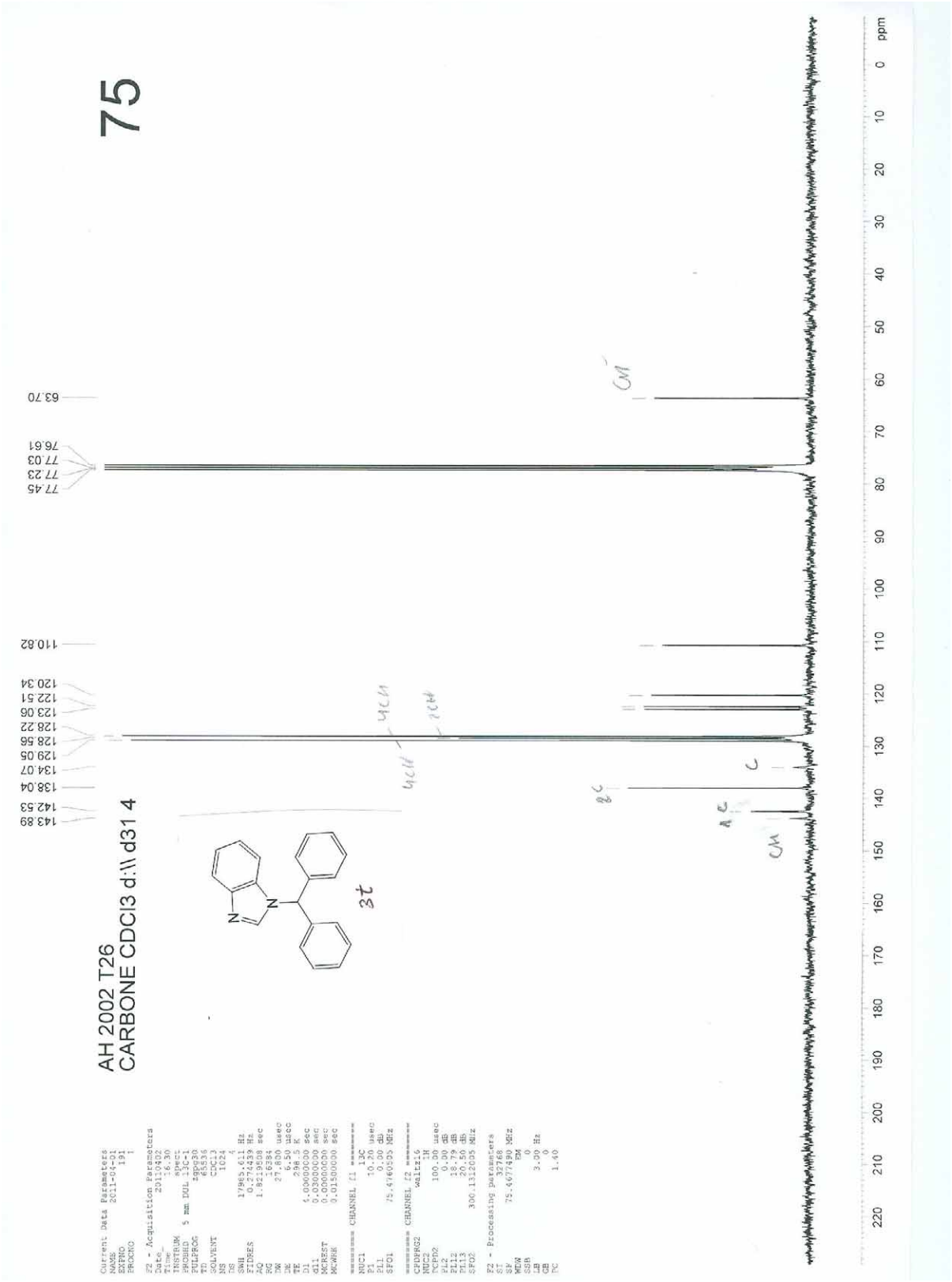
3R

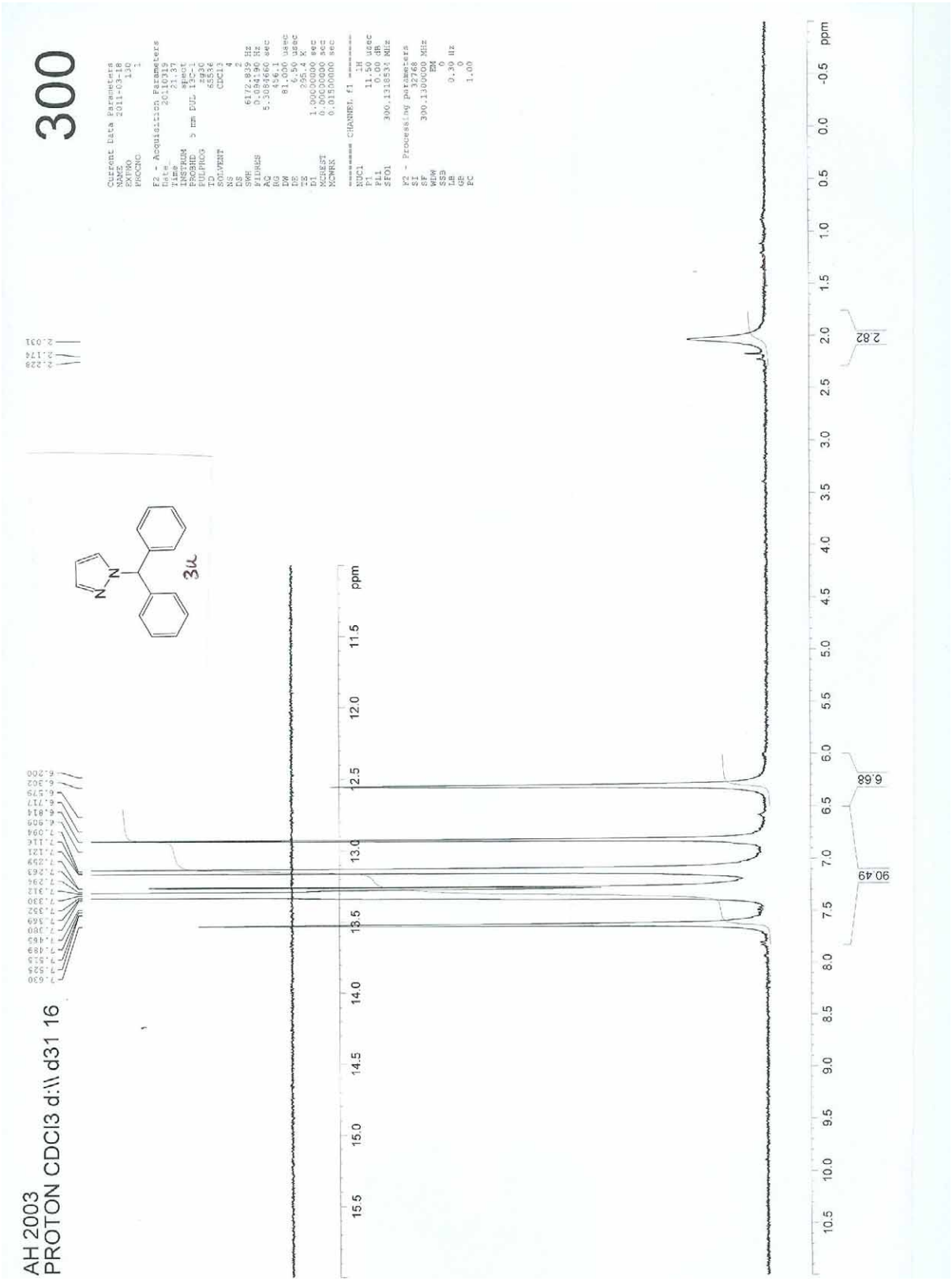

AH1845 T36
NOESY Correlations spatiales H...H
ppm
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 ppm

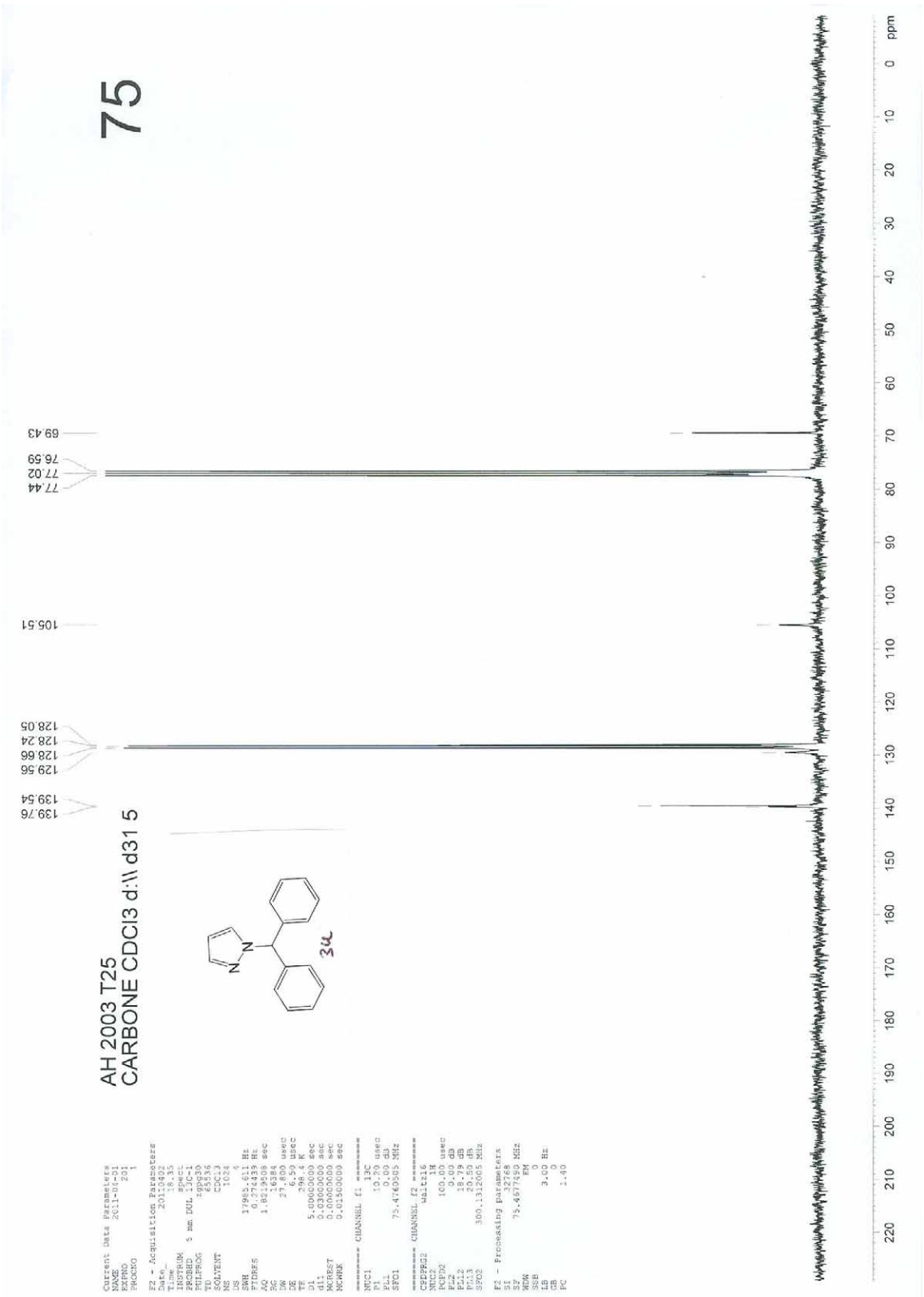

2010-12-17
AH 1848 T53
PROTON CDCl3 d:\\ d31 16
MeO
OMe
3s
3.24
6.72
1.00
1.93
0.92
0.97
1.00
0.97
f1 (ppm)

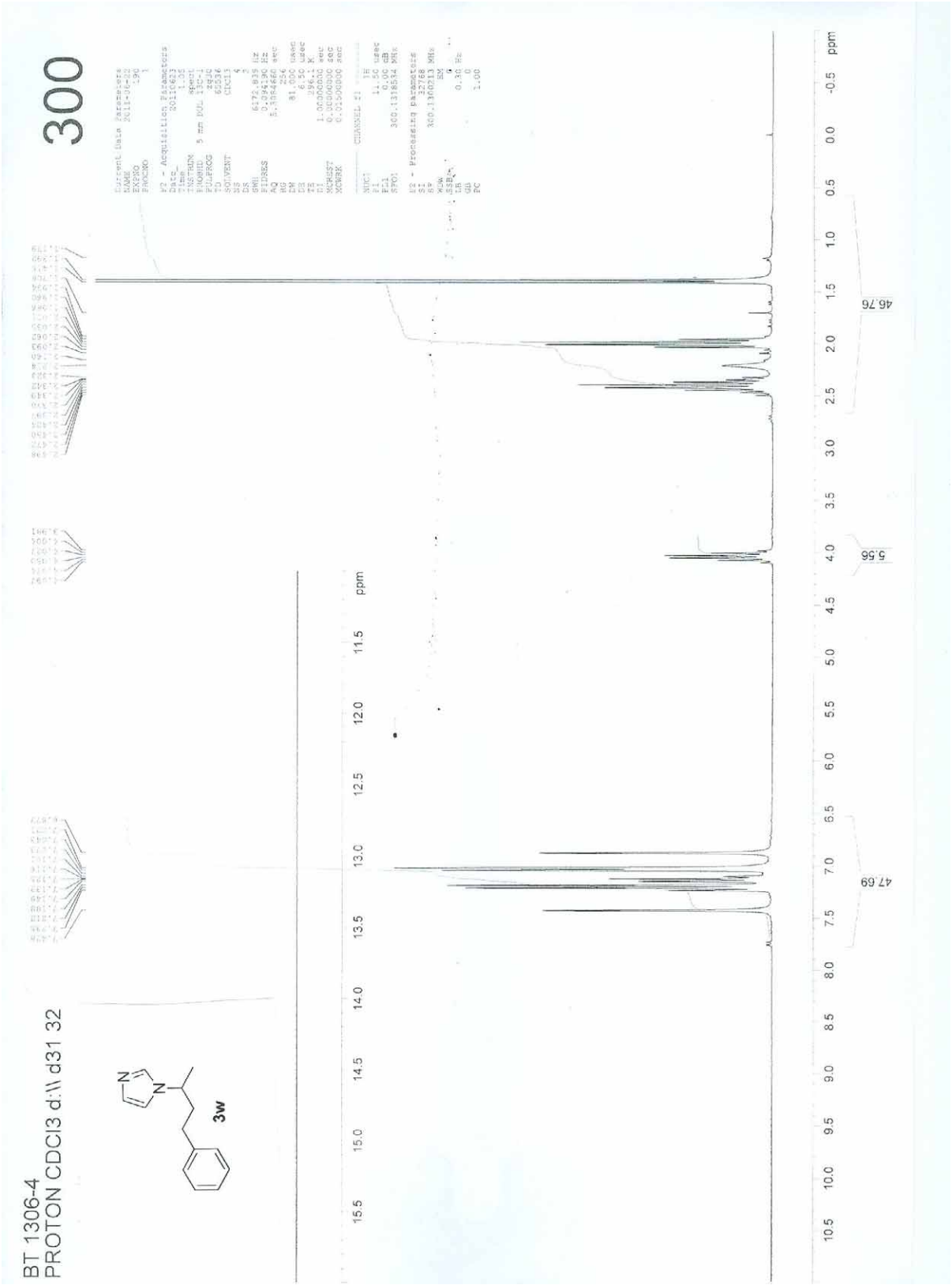

2010-12-17
AH 1848 T53
JMOD CDCl3 d:\\ d31 16
MeO
OMe
3s
f1 (ppm)

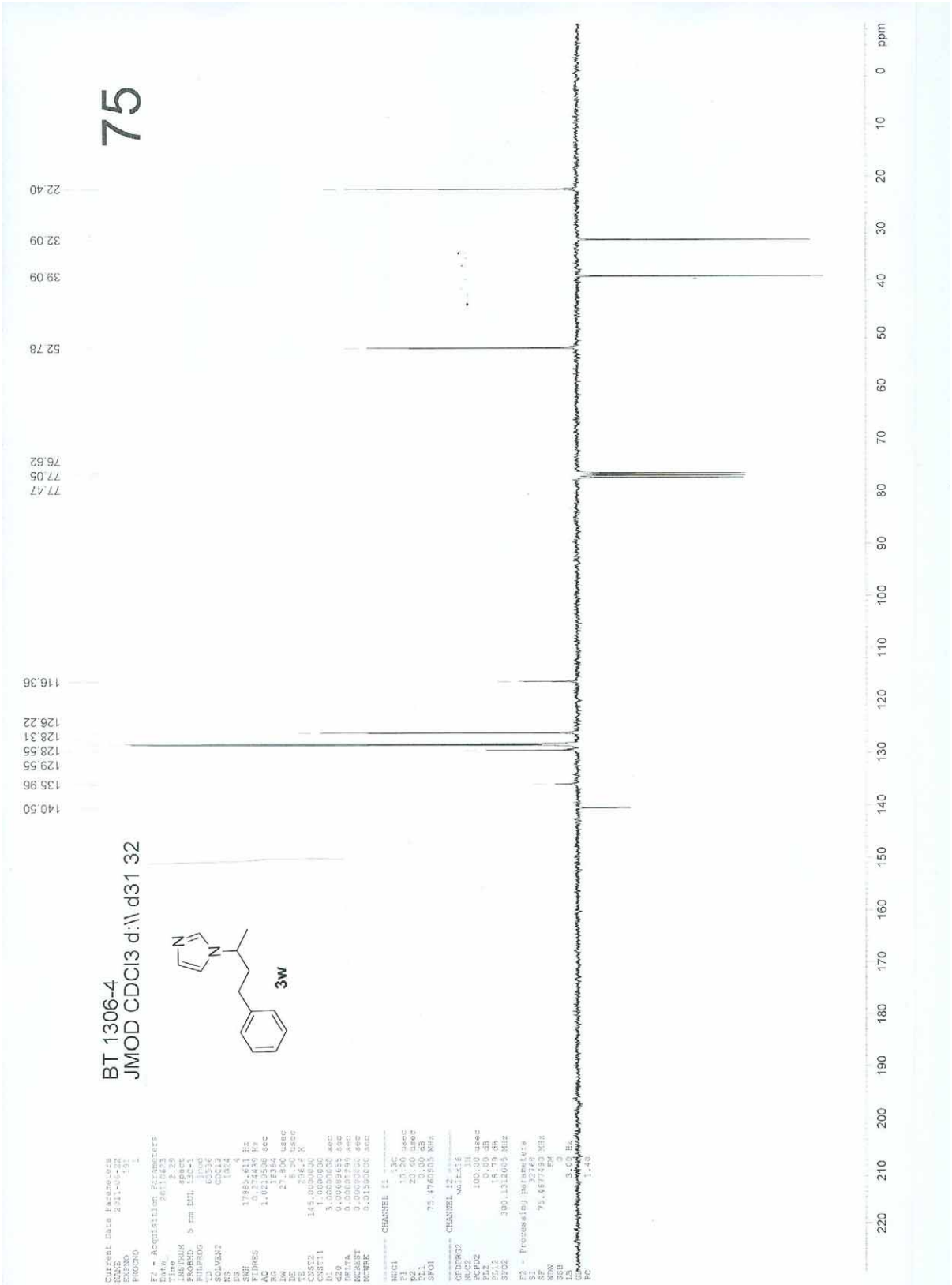

AH 2002 T26
PROTON CDCl3 d:\\ d31 4
300
3t
4.03
96.97
ppm


75
AH 2002 T26
CARBONE CDCl3 d:\\ d31 4
3t
143.89
142.53
138.04
134.07
129.05
128.56
128.22
123.06
122.51
120.34
110.82
77.45
77.23
77.03
76.61
63.70
ppm


AH 2003
PROTON CDCl3 d:\\ d31 16
300
3u
2.82
6.68
90.49
ppm


75
AH 2003 T25
CARBONE CDCl3 d:\\ d31 5
34
139.76
139.54
129.56
128.66
128.24
128.05
105.51
77.44
77.02
76.59
69.43
ppm


300
BT 1306-4
PROTON CDCl3 d:\\ d31 32
3w
46.76
5.56
47.69
ppm


75
BT 1306-4
JMOD CDCl3 d:\\ d31 32
3w
22.40
32.09
39.09
52.78
76.62
77.05
77.47
116.36
126.22
128.31
128.55
129.55
135.96
140.50
ppm